APPENDIX K

Applying Envision 1.0 to Wastewater Projects

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Applying Envision 1.0 to Water Projects

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Introduction

When the Envision Guidance Manual was introduced in 2013, the Water Environment Federation (WEF) assembled a group of water professionals from the Biosolids, Collection Systems, Municipal Resource Recovery Facility, Stormwater, and Utility Management WEF Committee's to form the WEF Envision Task Force. The Task Force, led by Derek Gardels and Evan Bowles, was tasked to evaluate the applicability and relevance of each Envision Credit as it relates to the water industry.

The following table indicates the WEF Envision Task Force's applicability recommendation for the Envision credits listed in the Envision Guidance Manual. The applicability scaled used for these recommendations was:

- Highly Applicable (●) – Many opportunities and pathways to achieve high point levels, especially towards the conservative and restorative levels.
- Applicable (◔) – Quite a few opportunities and pathways to achieve relative average point levels at the enhanced to superior levels.
- Moderately Applicable (⊖) – Multiple potential opportunities and pathways to achieve sufficient points at the improved to enhanced levels.
- Limited Applicability (⊕) – Relatively few to no opportunities and pathways to achieve sufficient points to obtain even the improved level. To achieve the smallest amount of points may not justify the cost.

Please note, that if an applicability is not listed for a specific credit or project type, that the task force did not have a formal recommendation for that credit.

<table>
<tr><th>Envision Credit</th><th>Collection Systems

(CS)</th><th>Stormwater

(SW)</th><th>Biosolids

(BS)</th><th>Municipal Resource Recovery Facility (MRRF)</th></tr>
<tr><td colspan="5">QUALITY OF LIFE</td></tr>
<tr><td colspan="5">Purpose</td></tr>
<tr><td>QL 1.1 Improve Community Quality of Life</td><td colspan="4">● (Highly Applicable)</td></tr>
<tr><td>QL 1.2 Stimulate Sustainable Growth and Development</td><td colspan="4">● (Highly Applicable)</td></tr>
<tr><td>QL 1.3 Develop Local Skills & Capabilities</td><td colspan="4">◔ (Applicable)</td></tr>
<tr><td colspan="5">Well-Being</td></tr>
<tr><td>QL 2.1 Enhance Public Health & Safety</td><td colspan="4">⊖ (Moderately Applicable)</td></tr>
<tr><td>QL 2.2 Minimize Noise and Vibration</td><td colspan="4">⊖ (Moderately Applicable)</td></tr>
<tr><td>QL 2.3 Minimize Light Pollution</td><td colspan="4">⊕ (Limited Applicability)</td></tr>
<tr><td>QL 2.4 Improve Community Mobility & Access</td><td colspan="4">◔ (Applicable)</td></tr>
<tr><td>QL 2.5 Encourage Alternative Modes of Transportation</td><td colspan="4">⊕ (Limited Applicability)</td></tr>
</table>

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Envision Credit	Collection Systems (CS)	Stormwater (SW)	Biosolids (BS)	Municipal Resource Recovery Facility (MRRF)
QL 2.6 Improve Site Accessibility, Safety and Wayfinding	●			
Community				
QL 3.1 Preserve Historic & Cultural Resources	●			
QL 3.2 Preserve Views & Local Character	●			
QL 3.3 Enhance Public Space	◔			
LEADERSHIP				
Collaboration				
LD 1.1 Provide Effective Leadership & Commitment	●			
LD 1.2 Establish A Sustainability Management System	●			
LD 1.3 Foster Collaboration & Teamwork	●			
LD 1.4 Provide for Stakeholder Involvement	●			
Management				
LD 2.1 Pursue By-Product Synergy Opportunities	●			
LD 2.2 Improve Infrastructure Integration				
Planning				
LD 3.1 Plan For Long-Term Monitoring & Maintenance	◔			
LD 3.2 Address Conflicting Regulations & Policies	●			
LD 3.3 Extend Useful Life	CS - ◔; WW - ◔; BS - ◔; SW - ●			
RESOURCE ALLOCATION				
Materials				
RA 1.1 Reduce Net Embodied Energy		◑		◑
RA 1.2 Support Sustainable Procurement Practices		◑	◑	◑
RA 1.3 Use Recycled Materials		◑		◔
RA 1.4 Use Regional Materials	◑	◑		◑
RA 1.5 Divert Waste From Landfills		◑	●	◑

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<table>
<tr><th>Envision Credit</th><th>Collection Systems

(CS)</th><th>Stormwater

(SW)</th><th>Biosolids

(BS)</th><th>Municipal Resource Recovery Facility (MRRF)</th></tr>
<tr><td>RA 1.6 Reduce Excavated Materials Taken Off Site</td><td></td><td>◓</td><td></td><td>◔</td></tr>
<tr><td>RA 1.7 Provide For Deconstruction & Recycling</td><td>◓</td><td>◓</td><td></td><td>◓</td></tr>
<tr><td colspan="5">Energy</td></tr>
<tr><td>RA 2.1 Reduce Energy Consumption</td><td>◓</td><td></td><td>●</td><td>●</td></tr>
<tr><td>RA 2.2 Use Renewable Energy</td><td></td><td></td><td>◓</td><td>●</td></tr>
<tr><td>RA 2.3 Commission & Monitor Energy Systems</td><td></td><td></td><td>●</td><td>◔</td></tr>
<tr><td colspan="5">Water</td></tr>
<tr><td>RA 3.1 Protect Fresh Water Availability</td><td></td><td>●</td><td></td><td>◓</td></tr>
<tr><td>RA 3.2 Reduce Potable Water Consumption</td><td></td><td>●</td><td>◓</td><td></td></tr>
<tr><td>RA 3.3 Monitor Water Systems</td><td></td><td></td><td></td><td>◔</td></tr>
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<tr><td>NW 1.2 Protect Wetlands & Surface Water</td><td colspan="2">●</td><td colspan="2"></td></tr>
<tr><td>NW 1.3 Preserve Prime Farmland</td><td colspan="2"></td><td colspan="2">⊕</td></tr>
<tr><td>NW 1.4 Avoid Adverse Geology</td><td colspan="2">◔</td><td colspan="2">●</td></tr>
<tr><td>NW 1.5 Preserve Floodplain Functions</td><td colspan="2">◔</td><td colspan="2"></td></tr>
<tr><td>NW 1.6 Avoid Unsuitable Development on Steep Slopes</td><td colspan="2">◓</td><td colspan="2">◓</td></tr>
<tr><td>NW 1.7 Preserve Greenfields</td><td colspan="2">◓</td><td colspan="2">◓</td></tr>
<tr><td colspan="5">Land and Water</td></tr>
<tr><td>NW 2.1 Manage Stormwater</td><td colspan="2">●</td><td colspan="2">●</td></tr>
<tr><td>NW 2.2 Reduce Pesticide & Fertilizer Impacts</td><td colspan="2">◓</td><td colspan="2">●</td></tr>
<tr><td>NW 2.3 Prevent Surface & Groundwater Contamination</td><td colspan="2">◓</td><td colspan="2">●</td></tr>
<tr><td colspan="5">Biodiversity</td></tr>
<tr><td>NW 3.1 Preserve Species Biodiversity</td><td colspan="2">●</td><td colspan="2">◓</td></tr>
<tr><td>NW 3.2 Control Invasive Species</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>NW 3.3 Restore Disturbed Soils</td><td colspan="2">●</td><td colspan="2">●</td></tr>
<tr><td>NW 3.4 Maintain Wetland & Surface Water Functions</td><td colspan="2">●</td><td colspan="2"></td></tr>
</table>

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Envision Credit	Collection Systems (CS)	Stormwater (SW)	Biosolids (BS)	Municipal Resource Recovery Facility (MRRF)
CLIMATE AND RISK				
Emissions				
CR 1.1 Reduce Greenhouse Gas Emissions	●			
CR 1.2 Reduce Air Pollutant Emissions	●			
Resilience				
CR 2.1 Assess Climate Threat	●			
CR 2.2 Avoid Traps & Vulnerabilities	●			
CR 2.3 Prepare For Long-Term Adaptability	◕			
CR 2.4 Prepare For Short-Term Hazards	◕			
CR 2.5 Manage Heat Island Effects	●			

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SECTION 1 – QUALITY OF LIFE

1 Quality of Life - Purpose

1.1 QL 1.1 Improve Community Quality of Life

1.1.0 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

1.1.0.1 Objective

Improve the net quality of life of all communities affected by the project and mitigate negative impacts to communities.

1.1.0.2 Relevance

HA – Highly applicable.

Holistic assessment and collaboration to make a net positive contribution of the host and nearby affected communities. Through rehabilitation of important community assists, upgraded and extended access, increased safety, improved environmental quality and additional infrastructure capacity, the project substantially reinvigorates the host and nearby communities.

1.1.0.3 Relevant Actions

- Assess whether the project would generate wastewater or place extra demand on sewer or wastewater treatment facilities
- Assess whether Combined Sewer Overflow's (CSO) will be an issue upon the project's completion
- Assess whether the project would increase convenience to the community
- Assess whether the project would improve cleanliness of the neighborhood as a whole

1.1.0.4 Potential Credit Application

- Increase attention to community needs, goals, plans and their relation to the project
- Increase thoroughness and participatory engagement by which community goals and plans are incorporated
- Give additional consideration to existing conditions
- Look for opportunities to rehabilitate assets
- Achieve strong endorsement from stakeholders and community leaders
- Recognize projects that provide significant benefits to affected communities as well as reduce or eliminate negative impacts

1.1.0.5 Other Information and Resources

1. W.A. Wallace, Project Sustainability Management Guidelines, Unpublished manuscript, September 2010.
2. Adapted from The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 6.1: Promote equitable site development, Credit 6.2: Promote equitable site use.

1.2 QL 1.2 Stimulate Sustainable Growth and Development

1.2.0 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

1.2.0.1 Objective

Support and stimulate sustainable growth and development, including improvements in job growth, capacity building, productivity, business attractiveness and livability.

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1.2.0.2 Relevance

- HA – highly applicable
  Highly applicable at project level. Improves economic growth and development capacity of the community. Improve attractiveness through restoration of existing infrastructure, including physical, knowledge and social assets. Adaptive to changing conditions.
- Benchmark: Designed as an entity unto itself, simply meeting the planning and regulatory requirements. No overall assessment of its contribution to sustainable community growth and development is made. Performance improvement: Expand focus from a project-only look to community wide considerations. Make growth and development for business and people attractive through increased efficiency and cultural/recreational resources. Seek to restore, redevelop and repurpose community assets.

1.2.0.3 Relevant Actions

- To what level and extent has the project owner and the project team made public commitments, both organizational and project specific, to improving sustainable performance?
- Assess socio-economic vitality and attractiveness of the community for both work and life
- Assess the project's impact on the community's sustainable economic growth and development
- Assess if businesses want to relocate to the area because of overall benefits and attractiveness
- Assess what is realistic and affordable, and sets the community on an efficient path for development
- Assess infrastructure viability and whether it should be repaired, replaced and/or refurbished on a cost-effective schedule
- Have a set of alternatives ready covering business, industry, cultural and recreational elements
- Look at potential ways to educate the community on project benefits
- Preserves environment for future generations

1.2.0.4 Potential Credit Application

- To achieve maximum points, at all early development stages, the project owner and the project team work with the community to identify existing community assets in the natural or built environment, which if restored, would improve the economic growth and development capacity of the community
- Conduct public hearings for the public to comment on relevant actions and to add input
- Evaluate projected job opportunities in the community relevant to the project

1.2.0.5 Other Information and Resources

1. http://www.sustainabledevelopmentinfo.com/the-definition-of-sustainable-development/
2. Institute for Sustainable Infrastructure, Envision v. 2: A Rating System for Sustainable Infrastructure (2012).

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1.3 QL 1.3 Develop Local Skills and Capabilities

1.3.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

1.3.1.1 Objective

Expand the knowledge, skills, and capacity of the community workforce to improve their ability to grow and develop.

1.3.1.2 Relevance

A – Applicable

The design and construction phase will be important for local skills and development but once the project is complete, not all projects especially relevant to stormwater/wastewater need to be maintained every day. Benchmark: Hiring and training of local worker or firms is strictly a cost decision and is predominantly unskilled labor. Training is done as needed or as required by regulations and standards.

1.3.1.3 Relevant Actions

- Consider bringing in an outside professional to train local workers for relevant projects
- How does non community participation affect the quality of life of the community?
- How does the project create recreational opportunities for the community?

1.3.1.4 Potential Credit Application

- Identify educational and employment needs and shortfalls within the project scope
- Team will work with the community and educate and inform to improve the skill base thus improving long term competitiveness
- Will the project contribute to long term community competitiveness?
- To what level and extent have the project owner and the project team made public commitments, both organizational and project specific, to improving sustainable performance?
- Target minority and lower income groups
- Propose educational and training programs to be developed and implemented in the future

1.3.1.5 Other Information and Resources

1. Institute for Sustainable Infrastructure, Envision v. 2: A Rating System for Sustainable Infrastructure (2012).
2. http://www.hrgreen.com/Files/HRGreeen-Conventional_vs_Sustainable-08022012.pdf

2 Quality of Life – Well-Being

2.1 QL 2.1 Enhance Public Health & Safety

2.1.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

2.1.1.1 Objective

Take into account the health and safety implications of using new materials, technologies or methodologies above and beyond meeting regulatory requirements.

2.1.1.2 Relevance

A - Applicable

There is not a set implementation plan, these suggestions do not need to be implemented during project construction and only considered in the design phase as long as new technologies and methodologies are being considered. Point can be achieved relatively easily for projects utilizing new equipment and materials.

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2.1.1.3 Relevant Actions

- Project team should consult with government officials to assess possible risk and exposure during project design, construction and completion. This should include the creation of a health and safety plan and protocols for new materials, technologies, and methodologies that don't already have one. Potential Credit Applications

2.1.1.4 Potential Credit Application

- Look at potential technologies that affect air and water quality
- Has the constructor had all safety protocols evaluated by the appropriate health and safety officials?
- Remove an environmental impairment that would otherwise stigmatize the property
- Have projects incorporate extra safety measures such as security cameras, emergency buttons, etc.
- Target low income areas with high crime rates as project areas to give it more public access for public utilization
- Assess potential technologies and equipment for health and safety benefits
- Evaluate the resiliency of the project space in the event of a natural disaster (i.e., landslide, flashfloods, tornados) to protect public and worker health and safety
- Consult government officials responsible for public health and safety to assess risk

2.1.1.5 Other Information and Resources

1. Institute for Sustainable Infrastructure, Envision v. 2: A Rating System for Sustainable Infrastructure (2012).

2.2 QL 2.2 Minimize Noise and Vibration

2.2.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

2.2.1.1 Objective

Minimize noise and vibration generated during construction and in the operation of the constructed works to maintain and improve community livability.

2.2.1.2 Relevance

MA – Moderately applicable

Noise pollution in this section depends strongly on the proximity of the project to communities. During wastewater projects, some of the process machines can make noticeable noise during the construction process. Collection systems projects are typically located close to communities and the construction process for these can cause noise pollution. On-going noise disruptions can occur due to installed infrastructure, typically wastewater treatment plants and pumping stations, but also include such things as operation & maintenance (O&M) repair or proactive maintenance activities.

2.2.1.3 Relevant Actions

- Assess how many people the project will impact in the surrounding communities. Design the project so it causes the least amount of noise pollution during construction. If noise limits are still going to bother a population, educate the population on what projects will be built and how the noise it will affect their daily lives. Use innovative technologies available to mitigate reduce noise pollution.

2.2.1.4 Potential Credit Application

- Have appropriate studies carried out to predict noise levels
- Project team sets construction specifications for noise and vibration limits
- Establish program to monitor noise and vibration during project operation
- Coordinate with City and local utilities to minimize sound disturbances during construction

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- Make public aware of upcoming projects that would affect their daily routines
- Utilize sound proofing noise barriers, design mechanical equipment to be away from exterior spaces
- Training workers to operate and be more aware of noise pollution and its effects on surrounding communities
- Using GIS or other models to predict roadway noise, local topography, meteorology, traffic operations, and hypothetical mitigation of the noise
- Limit use of heavy duty vehicles during project construction
- Investigate potential traffic control routes to limit braking and acceleration of cars driving by the project site
- See if the project can provide an area with quiet outdoor spaces
- Specify equipment (new or specific brand/quality) that minimizes noise and vibrations

2.2.1.5 Other Information and Resources

1. http://noisepollution.weebly.com/mitigation-and-control.html
2. Institute for Sustainable Infrastructure, Envision v. 2: A Rating System for Sustainable Infrastructure (2012).

2.3 QL 2.3 Minimize Light Pollution

2.3.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

2.3.1.1 Objective

Prevent excessive glare, light at night, and light directed skyward to conserve energy and reduce obtrusive lighting and excessive glare.

2.3.1.2 Relevance

LA – limited applicability

Light pollution depends strongly on the proximity of the project to communities. Upstream facilities (such as pumping stations) can be in close proximity of surrounding communities, and will sometimes require lighting for security purposes. During wastewater and stormwater projects, some outdoor equipment may require additional lighting especially during evening work and winter months.

2.3.1.3 Relevant Actions

- Assess how many people the project will impact in the surrounding communities and ask the community how the project affects them. Design the project so it causes the least amount of light pollution during construction. If light use will still bother a population or organisms in the surrounding area, educate the population on what projects will be built and use light pollution mitigation techniques to protect the environment and organisms effected. Use innovative technologies available to mitigate light pollution and look at non-lighting alternatives

2.3.1.4 Potential Credit Application

- Have appropriate studies carried out to predict light pollution levels for projects.
- Look at environmental regulations for the affect light pollution could have on surrounding animal species (i.e. turtles, owls, etc.):
    - Create clarifiers to have low lighting for bird species at night
    - Create low lighting during project construction (especially at night) so turtles do not go towards the project site instead of the ocean
- Look at energy saving lightbulbs to save money during project development
- Work during the day time to prevent night time light use
- Utilize natural light for projects indoors to save energy and lighting costs
- Project team sets construction specifications for lighting zone levels

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- Establish program to monitor lighting levels during project operation (especially for outdoor projects)
- Coordinate with City and local utilities to minimize light disturbances during project construction
- Make public aware of upcoming projects that would affect their daily routines related to lighting
- Training workers to operate and be more aware of light pollution and its effects on surrounding communities
- Evaluate if the project once complete has cohesive zoning balanced against sensitive environments and receptors
- Consider utilizing downward facing, low wattage, or motion sensored lighting in facilities close to surrounding communities.

2.3.1.5 Other Information and Resources

1. Institute for Sustainable Infrastructure, Envision v. 2: A Rating System for Sustainable Infrastructure (2012).

2.4 QL 2.4 Improve Community Mobility and Access

2.4.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

2.4.1.1 Objective

Locate, design and construct the project in a way that eases traffic congestion, improves mobility and access, does not promote urban sprawl, and otherwise improves community livability.

2.4.1.2 Relevance

A – Applicable

Location selection for the project will not always be ideal and could interfere with traffic patterns and walkability for communities. Team does not necessarily coordinate with all utilities, stores and other surrounding industry which could affect traffic and accessibility for communities. For many cases with the exception of stormwater, public access is not encouraged.

2.4.1.3 Relevant Actions

- Make sure the location, design and construction of the project helps to ease traffic congestion, improves walkability. Also construct project to look nice so it does not detour people from moving near project site.
- Consider the alignment of the plans to extend services areas with the overall community development goals.
    - Does the extension support the community goals?
    - Remember to consider urban sprawl.

2.4.1.4 Potential Credit Application

- For Collection Systems and Stormwater project team needs to look into the pipeline design layout as it affects traffic patterns
- For Collection Systems and Stormwater projects, consider working with government agencies to coordinate infrastructure work with transportation projects, including traffic changes, bike lane installations, and sidewalk repairs.
- Construct the project during times of low traffic flow and hours that does not affect normal traffic patterns. Utilize one or two lanes of traffic instead blocking roads completely.
- Project design incorporates easement use to limit sprawl or dependence on a single mode of transportation
- Look at alternative means of transportation for materials that need to be moved offsite instead of contributing to traffic congestion (i.e. Wastewater sludge removal)

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- Educate public on upcoming projects in surrounding communities so the population can find alternative means of transportation to mitigate traffic congestion
- Coordinate with facilities that provide materials to or out of project site so they can help at finding easiest means of transporting these materials
- Using GIS or other models to predict local topography, meteorology, traffic operations, and hypothetical mitigation of traffic
- Investigate potential traffic control routes to limit braking and acceleration of cars driving by the project site

2.4.1.5 Other Information and Resources

1. Institute for Sustainable Infrastructure, Envision v. 2: A Rating System for Sustainable Infrastructure (2012).

2.5 QL 2.5 Encourage Alternative Modes of Transportation

2.5.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

2.5.1.1 Objective

Improve accessibility to non-motorized transportation and public transit. Promote alternative transportation and reduce congestion.

2.5.1.2 Relevance

LA – Limited Applicability

Location selection for the project will not always be ideal and could interfere with traffic patterns and walkability for communities. Team does not necessarily coordinate with all utilities, stores and other surrounding industry which could affect traffic and accessibility for communities. For many cases with the exception of stormwater, public access is not encouraged.

2.5.1.3 Relevant Actions

- Make sure the location, design and construction of the project helps to ease traffic congestion, improves walkability. Make sure the project focuses on alternative modes of transportation for the community and alternative modes of transportation for getting rid of sludge and other materials used during project construction.
- Encourage construction crew, operation staff, and facility staff to utilize alternative transportation.

2.5.1.4 Potential Credit Application

- Increase ease of handicap accessibility so public transportation is not the only option for travelling short distances
- Project should be located in an area that encourages non-motorized use to access it
- For Collection Systems and Stormwater project team needs to look into the pipeline design layout as it affects traffic patterns.
- For Collection Systems and Stormwater projects, consider working with government agencies to coordinate infrastructure work with transportation projects, including traffic changes, bike lane installations, and bus stop and sidewalk repairs.
- Construct the project during times of low traffic flow and hours that does not affect normal traffic patterns to reduce congestion
- Utilize one or two lanes of traffic instead blocking roads completely to reduce congestion
- Look at alternative means of transportation for materials that need to be moved offsite instead of contributing to traffic congestion (i.e. Wastewater sludge removal)
- Educate public on upcoming projects in surrounding communities so the population can find alternative means of transportation to mitigate traffic congestion
- Coordinate with facilities that provide materials to or out of project site so they can help at finding easiest means of transporting these materials

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- Using GIS or other models to predict local topography, meteorology, traffic operations, and hypothetical mitigation of traffic

2.5.1.5 Other Information and Resources

1. Institute for Sustainable Infrastructure, Envision v. 2: A Rating System for Sustainable Infrastructure (2012).

2.6 QL 2.6 Improve Site Accessibility, Safety and Wayfinding

2.6.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

2.6.1.1 Objective

Improve user accessibility, safety, and wayfinding of the site and surrounding areas.

2.6.1.2 Relevance

Highly applicable - HA.

There are many opportunities to improve public safety, user accessibility, and wayfinding of the site. These options need to be considered in the design phase and after the project is complete to maintain neighborhood safety. It is also important to consider not only the public safety and wayfinding of the surrounding community, but also of the operation crew, facility staff, and construction crews.

2.6.1.3 Relevant Actions

- During the design of the project, the team needs to consider impact on surroundings and considers the physical safety of workers and community members in the potential vandalism and crime that could occur during project implementation. Work with local police for assistance in enforcement.
- Consider how promoting natural and infrastructure features to engage and educate the community can be a benefit.

2.6.1.4 Potential Credit Application

- Increase ease of handicap accessibility so public transportation is not the only option for travelling short distances
- Remove an environmental impairments that would otherwise stigmatize the property
- Have projects incorporate extra safety measures such as security cameras, emergency buttons, etc.
- Target low income areas with high crime rates as project areas to give it more public access for public utilization
- Assess potential technologies and equipment for health and safety benefits
- Evaluate the resiliency of the project space in the event of a natural disaster (i.e., landslide, flashfloods, tornados) to protect public and worker health and safety
- Provide a safety/emergency plan for the surrounding communities and the project workers in the event something in the project goes wrong
- Consult government officials responsible for public health and safety to assess risk

2.6.1.5 Other Information and Resources

1. Institute for Sustainable Infrastructure, Envision v. 2: A Rating System for Sustainable Infrastructure (2012).

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3 Quality of Life- Community

3.1 QL 3.1 Preserve Historic and Cultural Resources

3.1.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

3.1.1.1 Objective

Preserve or restore significant historical and cultural sites and related resources to preserve and enhance community cultural resources.

3.1.1.2 Relevance

Highly Applicable - HA

For stormwater and collection systems projects since, project will most likely be using existing infrastructure. For stormwater this is highly applicable for restoring existing green spaces. For others it will depend on project location and existence.

3.1.1.3 Relevant Actions

- During early design phases project team should look at potential opportunities to preserve or restore historical and cultural resources in the surrounding areas. Historical and cultural resources are defined as both architectural and archeological resources as well as tribal and cultural properties. Most historical resources fall under federal protection or statues so project team should evaluate those regulations prior to project design/construction.

3.1.1.4 Potential Future Application

- Assess whether the project is a cultural landmark before construction begins
- Work with regulatory agencies and surrounding community to identify cultural and historic resources
- Work with cultural stakeholders to develop a design approach
- Consult indigenous communities on cultural practices and traditions that might be affected during project construction (i.e. disturbing graves, temples, etc.)
- Consider adding native plants to the project site to help restore it to its original ecosystem as best as possible
- Incorporate into scope to have an archaeologist onsite when beginning project
- Ensure the project does not interfere with accessibility to tourism sites because tourism drives many communities economies

3.1.1.5 Other Information and Resources

1. Institute for Sustainable Infrastructure, Envision v. 2: A Rating System for Sustainable Infrastructure (2012).

3.2 QL 3.2 Preserve Views and Local Character

3.2.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

3.2.1.1 Objective

Design the project in a way that maintains the local character of the community and does not have negative impacts on community views.

3.2.1.2 Relevance

HA – Highly Applicable.

Holistic assessment and collaboration to make a net positive contribution of the host and nearby affected communities. Through rehabilitation of important community assets, upgraded and extended access, increased safety, improved environmental quality and additional

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infrastructure capacity, the project substantially reinvigorates the host and nearby communities to not negatively it but in a positive, healthy manner.

3.2.1.3 Relevant Actions

- Design team should consult with the community and local stakeholders representing minorities and the community as an entirety to understand community values and rules to see how project can restore and enhance the communities unique character
- Design team should consider how design buildings and public infrastructures (like pumping stations) can mimic the architecture of the surrounding community and disguise the purpose of infrastructure buildings.

3.2.1.4 Potential Future Application

- Consult with politicians representing each community
- Assess whether the project would increase convenience to the community
- Assess whether the project would improve cleanliness of the neighborhood as a whole
- Increase attention to community needs, goals, plans and their relation to the project
- Increase thoroughness and participatory engagement by which community goals and plans are incorporated
- Give additional consideration to existing conditions
- Look for opportunities to rehabilitate assets
- Achieve strong endorsement from stakeholders and community leaders before beginning project
- Recognize projects that provide significant benefits to affected communities as well as reduce or eliminate negative impacts
- Assess whether the project is a cultural landmark before construction begins
- Work with regulatory agencies and surrounding community to identify cultural and historic resources
- Work with cultural stakeholders to develop a design approach
- Consult indigenous communities on cultural practices and traditions that might be affected during project construction (i.e. disturbing graves, temples, etc.)
- Consider adding native plants to the project site to help restore it to its original ecosystem as best as possible
- Incorporate into scope to have an archaeologist onsite when beginning project
- Ensure the project does not interfere with accessibility to tourism sites because tourism drives many communities economies
- Hold a public hearing to allow public comment on project design

3.2.1.5 Other Information and Resources

1. Institute for Sustainable Infrastructure, Envision v. 2: A Rating System for Sustainable Infrastructure (2012).

3.3 QL 3.3 Enhance Public Space

3.3.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

3.3.1.1 Objective

Improve existing public space including parks, plazas, recreational facilities, or wildlife refuges to enhance community livability.

3.3.1.2 Relevance

A – Applicable

This project can only apply to all publicly owned areas or privately owned resources where public access has already been approved limiting space where project development can occur.

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3.3.1.3 Relevant Actions

- Project team consult with officials who own public space to ensure proposed project will increase the net benefit of the resource. Public space can be an urban or natural settings and includes but is not limited to parks, plazas, recreational facilities, and wildlife refuges.
- Project team needs to also consider enhancing and restoring areas that had previously been used for development.
- When working with buried infrastructure, design team should consider enhancements that can be made to public spaces.

3.3.1.4 Potential Future Application

- Reuse treated biosolids from local utilities as fertilizers to enhance beautification of public space in the community
- Educate the public on sustainable infrastructure reducing crime and encouraging health and vibrant neighborhoods
- Use native plant species to beautify and restore the project space
- Analyze the project and see if there are multiple benefits that can be accomplished
- Consult public agencies and other stakeholders about public space enhancement
- Investigate other, similar projects lesson learned to not make the same mistakes
- Target low income areas with high crime rates as project areas to give it more public access for public utilization
- Build the project resilient enough to withstand a natural disaster (i.e., landslide, flashfloods, tornados)
- Increase thoroughness and participatory engagement by which community goals and plans are incorporated
- Assess whether the project would increase convenience to the community
- Assess socio-economic vitality and attractiveness of the community for both work and life
- Assess the project's impact on the community's sustainable economic growth and development
- Assess what is realistic and affordable, and sets the community on an efficient path for development
- Look at potential ways to educate the community on project benefits
- Preserves environment for future generations

3.3.1.5 Other Information and Resources

1. Institute for Sustainable Infrastructure, Envision v. 2: A Rating System for Sustainable Infrastructure (2012).

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SECTION 2 - LEADERSHIP

1 Leadership – Collaboration

1.1 LD 1.1 Provide Effective Leadership & Commitment

1.1.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

1.1.1.1 Objective

Provide leadership and commitment to achieve project sustainability goals

1.1.1.2 Relevance

HA- Highly Applicable

Highly Applicable at an organizational level. At a project level, may range from LA to HA. For example, a simple project may not warrant the need for project specific sustainability policy statement.

1.1.1.3 Relevant Actions

- Background: Sustainability statements can be at an agency level, intermediate agency level (e.g. division, department, section, etc.), at an individual project level, or somewhere in between. Ideally, sustainability policy statements are consistent and related to each other.
- Review agency sustainability policy statements, both general and project-specific. If there is no agency sustainability policy statement, consider developing one. Have statement adopted by governing board. Consider developing project-specific sustainability statements
- Assess how high up within an organization sustainability statements are supported and promoted (e.g. governing board, executive level, division level, section, etc.).
- Consider developing or enhancing project-specific sustainability statement as part of an overall project goals setting process. Project-specific sustainability statements should integrate with agency policy statement
- Assess how widespread and public sustainability policy statements are displayed and promoted.
- Consider increasing public visibility of sustainable policy statements via different communication methods. Examples may include websites, printed material, project public meetings, social media, annual reports, press releases, etc.
- At the project level, is a project chartering session appropriate? If so and if undertaken, does it incorporate sustainability principles? Is it signed off at the highest levels of the organization?
- Are sustainability goals, as developed, appropriate and applicable for the project?
- When agency makes sustainability policy statements, assess how specific those statements are.
- Is there significant evidence that the agency is willing to commit resources (both people and $) to institute sustainable actions and performance. For example, is there staff whose job includes developing and implementing sustainable activities, programs and guidelines throughout the organization?
- Identify examples of sustainability actions and performance.
- Is staff empowered to implement actions that are sustainable?
- Assess how frequently organization regularly reports sustainability actions and to how wide of an audience. Does reporting go beyond the organization to the public?

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- Determine if organization has developed sustainability metrics. Does agency public report on these metrics
- Determine if employees are held accountable for sustainability as part of performance reviews.
- Educate and train staff across departments/divisions regarding sustainability
- Consider commitments from all team members: owner, designer, contractor, and stakeholders (mayor, collaborating departments/agencies, and community groups)

1.1.1.4 Potential Credit Application

- Develop a long term agency vision that includes significant sustainability elements
- Develop agency and project specific sustainability statements that are adopted at the highest level within the organization
- Publicize sustainability statements to as wide an audience as reasonable and practical, using different types of communication.
- Develop agency sustainability reporting, goals, and metrics
- Require managers to develop individual employee sustainability performance goals
- Consider a project chartering session that includes sustainability as a guiding principle
- Project goals include significant sustainability elements
- Project meetings routinely discussion sustainability as a key indicator or success and regularly search for means to increase sustainability elements.
- After project has been implemented, have a means in place to continue to monitor project achievements/metrics (in other words, determine if the project meeting goals it set out to achieve
- Review investment decisions in regards to sustainability and modify to support sustainable investing.
- Review and modify human resource policies and practices so as to support sustainability (e.g. telecommuting, flexible hours, diversity in hiring)
- Review and modify agency contracting/purchasing policies that support sustainability (e.g. "green" purchasing, require contractors to pay "livable wages"

1.1.1.5 Other Information and Resources

1. USEPA: "Planning for Sustainability, A Handbook for Water and Wastewater Utilities", 2012
2. University of Wisconsin Extension: "Toward a Sustainable Community: A Toolkit for Local Government", January 2007

1.2 LD 1.2 Establish a Sustainability Management System

1.2.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

1.2.1.1 Objective

- Create a project management system that can manage the scope, scale, and complexity of projects that improve sustainable performance
- Improve utility performance and long-term sustainability through the application of Plan-Do-Check-Act Management System.

1.2.1.2 Relevance

HA – Highly Applicable for wastewater treatment

As utilities adopt project planning and operational practices that can help them ensure their own sustainability and the sustainability of the communities they serve, adopting a robust management system, using the Plan-Do-Check-Act framework, can ensure the long-term success of their efforts and help achieve this credit. Basic elements of the management system would include planning, implementation, measuring progress, and adaptation based on the utility's sustainability goals and objectives.

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Benchmark: Has the basic elements of a management system consistent with the Plan-Do-Check-Act approach in place and being implemented to guide sustainability planning and practices.

Performance improvement: Specify measurable sustainability goals consistent with the community's overall priorities and track progress toward these goals over time using the sustainability management system

1.2.1.3 Relevant Actions

- Review the organization's current policy on sustainability or other relevant documents like a Strategic Plan
- When developing a strategic plan, use the Attributes of Effectively Managed Utilities (EUM) framework endorsed by EPA, WEF, and other national associations as the basis for creating a plan. Smaller utilities can use a similar framework developed by EPA and USDA
- Establish draft sustainability goals consistent with the strategic plan and seek input from local elected officials, board members, and other relevant community interests like transit, housing, watershed planning, etc.
- Modify goals, as necessary, based on community input, and develop measurable objectives for each goal to guide implementation of your management system
- Where feasible have the sustainability goals align with the Triple Bottom Line framework (environmental, economic, and social). Monitor performance against the project-specific TBL.
- Modify planning and operational practices and procedures and conduct training to ensure employee responsibilities in meeting objectives are understood and met
- Initiate a periodic review (annual is best) of the sustainability management system by top management and make revisions as necessary

1.2.1.4 Potential Credit Application

- Make sure your sustainability management system aligns with and supports your strategic goals and objectives—not the other way around
- Appoint someone as the overall "champion" of the sustainability management system—reporting directly to top management
- Proactively seek community input on your sustainability goals and implementation of your plan to ensure they support other relevant community priorities (e.g. GHG reductions, preservation and/or creation of open space, access to public transportation, improved recreational opportunities)
- Set a realistic number of sustainability goals (3-5) and measurable objectives
- Have top management clearly communicate the importance of the management system as the means of successfully meeting your goals to all employees
- Make sure appropriate training is provided to employees
- Incorporate achievement of the goals and objectives through the sustainability management system into manager's performance standards

1.2.1.5 Other Information and Resources

1. Attributes of Effectively Managed and Keys to Management Success www.watereum.org
2. Rural and Small Systems Guidebook to Sustainable Utility Management http://water.epa.gov/infrastructure/sustain/upload/SUSTAINABLE-MANAGEMENT-OF-RURAL-AND-SMALL-SYSTEMS-GUIDE-FINAL-10-24-13.pdf
3. Achieving Environmental Excellence: An Environmental Management Systems Handbook for Wastewater Utilities http://yosemite.epa.gov/water/owrccatalog.nsf/7322259e90d060c885256f0a0055db68/1b4f76f241a1ef8c85256ef30075b001!opendocument

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4. Planning for Sustainability: A Handbook for Water and Wastewater Utilities http://water.epa.gov/infrastructure/sustain/upload/EPA-s-Planning-for-Sustainability-Handbook.pdf
5. Sustainable and Effective Practices for Creating Your Water Utility Roadmap http://water.epa.gov/infrastructure/sustain/upload/Practices-Roadmap-FINAL-4-2-14.pdf

1.3 LD 1.3 Foster Collaboration & Teamwork

1.3.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

1.3.1.1 Objective

Eliminate conflicting design elements, and optimize system by using integrated design and delivery methodologies and collaborative processes

1.3.1.2 Relevance

Highly Applicable - HA

Applicability likely ranges from "moderately applicable" to "highly applicable" depending on the scale, scope, and complexity of the project, with a shift towards "highly applicable" as the project and number of players in the project increase in size.

1.3.1.3 Relevant Actions

- Project kick-off and chartering meeting with owner and project team to reinforce expectations of sustainability integration in project
- Multi-disciplinary project team engagement (internal: owner, owner's agent, engineer, contractor, subcontractors, commissioning agent(s); and external: public, neighbors, regulators, local elected officials, other city/municipality divisions, etc.) from early stages of project
- Systems-design approach accounts for and engages other infrastructure systems and municipal departments (e.g. power, transportation, parks and recreation, etc.) throughout the project planning, construction and, operation phases.
- Ongoing internal project communications emphasizing sustainable elements during planning, design, construction, and operation.
- Public design charrettes (see LD1.3) for community/stakeholder engagement are designed and attended by representatives of the multi-stakeholder team, not just the owner and designer.
- Sustainable design decisions are informed by (in progressing order): life cycle cost (LCC), life cycle analysis (LCA), systems approaches, and whole systems designs.
- Project contract documents are developed with to share risk (and rewards) between owner, designer, and builder.
- Systems are designed to minimize energy consumption with high-efficiency equipment and smart design to take advantage of gravity flow whenever possible.
- Systems are designed to maximize energy generation through the optimization and capture of chemical energy (biogas) and kinetic energy (hydroturbines) from wastewater solids and flowing water.
- Infrastructure systems maximize energy generation through the use of renewable energy (e.g. wind, solar, geothermal) via onsite production or offsite energy purchases.
- Nutrients are recovered and recycled via struvite precipitation (phosphorus) or biosolids land application (nitrogen and phosphorus).
- Water is recycled via reuse programs utilizing fit-for-purpose water quality.
- Coordinate with farmers, farm bureaus, and land reclamation facilities through the use of biosolids.

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1.3.1.4 Potential Credit Application

- Improved – Sustainable project elements are haphazardly incorporated or added on as an afterthought in an uncoordinated fashion, without an overall plan or formal organization
- Enhanced – The project's interconnectedness with other systems at the utility or municipality is understood and factored into decision-making. LCC evaluations are used for decision-making. Internal communications on sustainability elements are provided.
- Superior – The project team formally affirms their collaborative intentions through a chartering process. Project design charrettes engage a wide variety of internal and external stakeholders. Systems approaches are thoroughly incorporated. Risk and reward-sharing with the project team is formalized and new technologies/approaches are incorporated to enhance sustainability. Internal communications on sustainability elements are formalized and documented.
- Conserving – Systems-thinking and "whole systems design" principles are used through the project lifecycle. LCA evaluations are used for decision-making. Material inputs and outputs for both construction and project life are optimized, with minimized water, energy, and chemical inputs, minimized waste production, and maximized resource recovery (nutrients, energy, water, chemicals).

1.3.1.5 Other Information and Resources

1. Design of Municipal Wastewater Treatment Plants MOP 8, 5th Edition (WEF Manual of Practice 8: ASCE Manuals and Reports on Engineering Practice, No. 76), 2009.
2. Energy Conservation in Water and Wastewater Facilities - MOP 32 (WEF Manual of Practice), 2009.
3. The Energy Roadmap: A Water and Wastewater Utility Guide to More Sustainable Energy Management, Water Environment Federation, 2013.
4. Using Reclaimed Water to Augment Potable Water Resources, AWWA and WEF, 2008.

1.4 LD 1.4 Provide for Stakeholder Involvement

1.4.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

1.4.1.1 Objective

Establish sound and meaningful programs for stakeholder identification, engagement, and involvement in project decision making.

1.4.1.2 Relevance

HA – Highly Applicable to all water, wastewater, and stormwater projects.
This credit is highly applicable to all water, wastewater, and stormwater projects as they are typically funded out of the capital improvement program (CIP). Project and program managers of these CIP projects will be accountable to elected officials and rate paying customers.

Stakeholders cannot be managed, only stakeholder expectations can be managed. Balancing stakeholder interests is important, given their potential impact on the project's benefits. In addition to communication, it is extremely important to gain and maintain stakeholder buy-in for the projects objectives, benefits, and outcomes.

Wastewater plants (water reclamation facilities) can have a significant impact on the local community, in terms of potential odors, truck traffic, and aesthetics. Design and location of facilities relative to neighbors and areas of community activity can be modified or customized to not only minimize the negative impacts but possibly enhance the community based on

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community needs. Site conditions such as hills or valleys and prevailing winds, and site enhancements such as vegetative barriers, should be taken into consideration when siting and designing the facility. The type of treatment plant can affect the impact on the community. Understanding where the population centers are located relative to the plant siting, and the demographics of the neighbors are critical.

Informing the community about plans for initial construction, upgrades or expansion will soften the reception from these groups. Obtaining community suggestions is critical in the early stages of design to provide for the most appealing and least offensive facility.

1.4.1.3 Relevant Actions

The following steps are applicable to stakeholder involvement:
The following steps are applicable to stakeholder involvement:

1. Identification of Stakeholders – In this step the project manager methodically identifies and documents all stakeholders (both internal and external) into a stakeholder register. This register is created through a detailed stakeholder assessment and includes information such as their affiliation to the project, their ability to influence the project outcome, their degree of support and perceptions of the project.
   Key Deliverable – Stakeholder Register
2. Planning of Stakeholder Involvement – In this step, the project manager will develop a stakeholder involvement plan that outlines how all the project stakeholders will be engaged throughout the life of the project. This plan could include a list of metrics that will be used to measure the performance of stakeholder involvement activities (i.e. measures of participation, effectiveness of engagement etc.) and provide guidelines on how each group of stakeholders will be engaged at pre-established timelines.
   Key Deliverable – Stakeholder Involvement Plan
3. Involvement of Stakeholders – Actively engaging and interacting with stakeholders will allow the project team to consistently communicate the benefits and the value of the project, and in return solicit input from those stakeholders on ways to minimize negative impacts from the project. Key measures of stakeholder involvement include (but not limited to) positive contribution in realizing the projects objectives and benefits, frequency of communications with stakeholders etc. This step involves actively logging communication tools such as issue logs, meeting minutes, attendance, and tracking and reporting action items, feedback. Any non-participation of one or more stakeholder groups will need to be evaluated and addressed through root cause analysis.
   Key Deliverable – Tracking and Reporting of Stakeholder engagement metrics
4. Stakeholder Communication – Develop and manage communication plan that will support the stakeholder involvement plan that will typically outline content management (what needs to be shared) formal communication channels (who should share it and with whom), frequency of communication (how often should the information be shared), and methods of communication (email, letter, memo, meeting minutes etc.).
   Key Deliverable – Stakeholder Communication Plan

1.4.1.4 Potential Credit Application

- Improved – Limited understanding, use, and application of stakeholder engagement tools or public input limited to state regulations and statute. Communication is unidirectional (ex. project manager to all stakeholders)
- Enhanced – Existence of one or more stakeholder engagement tools (stakeholder register, stakeholder involvement plan, metrics, and communication plan). Evidence

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of use of one or more stakeholder engagement tools. Evidence of active stakeholder engagement and opportunities for stakeholder feedback.

- Superior – Existence of formal tools such as stakeholder register, stakeholder involvement plan, stakeholder metrics, and communication plan. Evidence of engaging a wider community in the project. Measureable benefits of stakeholder engagement demonstrating transparency in project decision-making.
- Conserving – Credible and formal stakeholder engagement program including the existence of formal stakeholder register, stakeholder involvement plan, stakeholder metrics, and communication plan. Evidence of applying these tools to actively engage and manage stakeholder expectations. Evidence of community engagement and relationship development, include tracking and reporting of stakeholder engagement metrics. Measureable benefits of stakeholder engagement demonstrating transparency in project decision making and stakeholder feedback.ie examples of how various stakeholders were engaged in resolving issues and gaining consensus, documented feedback

1.4.1.5 Other Information and Resources

1. Project Management Body of Knowledge (PMBOK Guide)
2. Project Resource Manual – CSI Manual of Practice

2 Leadership – Management

2.1 LD 2.1 Pursue By-product Synergy Opportunities

2.1.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

2.1.1.1 Objective

Reduce waste, improve project performance and reduce project costs by identifying and pursuing opportunities to use unwanted by-products or discarded materials and resources from nearby operations.

2.1.1.2 Relevance

HA – Highly Applicable for wastewater treatment, biosolids, collection systems, and stormwater projects

By-Product Synergy: Turning one company's waste, or by-product, into a valuable resource for another company, creating a synergy. A BPS project brings together companies and organizations to look for profitable synergies.

2.1.1.3 Relevant Actions

- Identify and characterize relevant waste streams of the project, and nearby facilities or waste streams
- Complete an assessment of the potential waste streams to determine if there are potential beneficial uses on this project.
- Contact and develop long-term relationships with the owners of the identified waste streams. Contact regulatory agencies to identify whether there are any regulatory barriers to implementation.
- Negotiate and secure at least one unwanted waste stream. To reach the restorative level of achievement, the project team must secure two or more waste streams.

2.1.1.4 Potential Credit Application

There are many potential applications for this credit. Some potential opportunities include:

- Glycerin as biodiesel waste byproduct that can be used as a carbon source

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- Biosolids from WWTP's (energy captured from biosolids or land application of biosolids)
- Anaerobic digestion of waste streams to produce methane
- Using recycled rubber in roads and landscaping
- Using recycled glass as aggregate
- Using tunnel spoils from tunneling in bedrock for aggregate in stormwater best management practices

2.1.1.5 Other Information and Resources

1. Water Environment Federation, Energy Roadmap: Driving Water and Wastewater Utilities to More Sustainable Energy Management (2012).
2. Opportunities for and Benefits of Combined Heat and Power at Wastewater Treatment Facilities" [U.S. EPA and Combined Heat and Power Partnership, April 2007].
3. U.S. Business Council for Sustainable Development

2.2 LD 2.2 Improve Infrastructure Integration

2.2.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

2.2.1.1 Objective

Design the project to take into account the operational relationships among other elements of community infrastructure which results in an overall improvement in infrastructure efficiency and effectiveness.

2.2.1.2 Relevance

Applicability ranges from "limited" to "highly applicable", depending upon the type of project. For example, a project that is simply replacing equipment in kind within the confines of a water reclamation facility has little opportunity to interact with other community infrastructure. At the other end of the spectrum, a major flood management project may have many opportunities and pathways for operational relationships with community infrastructure (e.g. parks, streets, freeways, forestry, sanitary sewers, water supply, bridges, land use plans).

2.2.1.3 Relevant Actions

Practitioner should consider the following question:

- Have all potential infrastructure stakeholders been contacted and involved from earliest stages of the project so as to ascertain potential coordination of other agencies' community infrastructure? In general, the earlier infrastructure stakeholders are aware and involved in a project, the higher the chance for leveraging community infrastructure.
- Has the practitioner attempted to cooperate and coordinate with other infrastructure initiatives or assets?

Infrastructure stakeholders would include but not be limited to:

- local and state DOT's, water supply managers, parks and recreation agencies, other local and regional sewer and flood management organizations, emergency response and management agencies, private utilities (e.g. gas, electric, telecommunications, pipeline owners), other local and regional public agencies (e.g. school systems, local public works, libraries, housing agencies, hospitals, etc).
- Other stakeholders who may be considered could include developers, as they often are required to construct new public infrastructure.
- Finally, even if not required and if appropriate, practitioner should consider contacting and coordinating with state and local historic preservation agencies.

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Practitioner should consider cooperating with other agencies so as to leverage planning, design and construction opportunities. For example, can flood management facilities be incorporated into parklands or converted into parklands? Can replacement of storm or sanitary sewers be included in design of roadway expansion/reconstruction?

Has project manager involved local and regional planning organizations to ensure consistency with various land use, neighborhood, bike and pedestrian plans, and economic development plans and potential long term infrastructure needs?

2.2.1.4 Potential Credit Application

- Jointly plan, design, and construct facilities so as to reduce overall construction costs. Develop formal agreements with infrastructure stakeholders to cooperate during planning, design and construction of joint facilities
- When planning projects, collaborate with other infrastructure stakeholders to determine if there are ways to enhance overall infrastructure system
- Explore opportunities for joint infrastructure system development with state, regional, and local planning and economic development agencies.
- As appropriate, work with local and state historic preservation organizations for possible preservation or reuse of historic assets. For example, using Works Progress Administration constructed facilities as part of the project.

Note that there are many potential ways to coordinate and cooperate with other infrastructure agencies/organizations. Further, there are many different organizations/agencies that own, operate, and develop infrastructure. Particularly for projects that are outside the geographic boundaries of a wastewater treatment facility, there will be no shortage of opportunities to coordinate, cooperate and leverage work with other infrastructure stakeholders.

3 Leadership – Planning

3.1 LD 3.1 Plan for Long-Term Monitoring and Maintenance

3.1.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

3.1.1.1 Objective

Put in place plans and sufficient resources to ensure as far as practical that ecological protection, mitigation, and enhancement measures are incorporated in the project and can be carried out.

3.1.1.2 Relevance

Applicable - Many wastewater projects have regulatory requirements for monitoring to ensure the projects have achieved an agreed-to performance criteria derived from the goals of the Clean Water Act. Also, given the expected service life of most wastewater capital projects, maintenance plans are necessary to ensure the 20-year, 50-year, etc., service lives are achieved.

3.1.1.3 Relevant Actions

- In the planning & design phase – O&M development needs to include more information than just cost estimates – frequency, personnel, and overall resource requirements should be developed. Monitoring plans should include locations, frequency, what is being monitored, and resource requirements.

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- In the construction phase – financial commitments to O&M and monitoring such as encumbered funds or assigned personnel should be documented.
- In the O&M phase – Records documenting the true O&M and monitoring efforts should be recorded.
- Process needed to share O&M costs with decision makers for future projects.

3.1.1.4 Potential Credit Application

- Documenting the O&M cost estimates, O&M schedule, expected resource requirements for materials, equipment, and personnel, and the commitment of the required resources.
- Documenting the monitoring plan – which should include a schedule, locations for monitoring, expected resources including personnel, and the commitment of the required resources.
- Documentation should illustrate that the monitoring and O&M plans are beyond minimum regulatory requirements.

3.1.1.5 Other Information and Resources

1. CSO Post-Construction Monitoring Guidance (US EPA, 2012) - http://water.epa.gov/polwaste/npdes/cso/upload/final_cso_pccm_guidance.pdf
2. Urban Stormwater BMP Performance Monitoring Guidance (US EPA, 2009) - http://water.epa.gov/scitech/wastetech/guide/stormwater/upload/2009-Stormwater-BMP-Monitoring-Manual.pdf
3. Green Infrastructure Maintenance Manual Development Process Plan (Philadelphia Water, 2012)
4. The Importance of Operation and Maintenance for the Long-Term Success of Green Infrastructure (US EPA, 2011) - http://water.epa.gov/grants_funding/cwsrf/upload/Green-Infrastructure-OM-Report.pdf

3.2 LD 3.2 Address Conflicting Regulations and Policies

3.2.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

3.2.1.1 Objective

Work with officials to identify and address laws, standards, regulations or policies that may unintentionally create barriers to implementing sustainable infrastructure.

3.2.1.2 Relevance

Highly Applicable – HA

Highly applicable for wastewater treatment, Biosolids, collection systems, and stormwater projects.

3.2.1.3 Relevant Actions

- Most federal and state water use and water quality regulations were developed years ago, long before technologies for effective reuse were available. Most state water rights legislation does not address the potential reuse of wastewater either. As technology improves in the water sector on many fronts, there is a high likelihood of regulatory barriers to implementation of these technologies.
- Early in conceptual design, the project team should schedule meetings with federal, state, and local regulatory agencies to identify potential conflicts. The intent of the credit is to:
- "Work with officials to identify and address laws, standards, regulations or policies that may unintentionally create barriers to implementing sustainable infrastructure."
- The potential conflicts need to be identified early to address these conflicts in a meaningful way. The engagement of federal, state, and local regulatory agencies at

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this level will also create synergies with the requirements for other Leadership category credits such as LD 1.4 – Provide for Stakeholder Involvement.

- The metric for level of achievement of LD 3.2 is as follows:
    - "Efforts to identify and change laws, standard, regulations and/or policies that may unintentionally run counter to sustainability goals, objectives and practices."
- A project team can reach the Improving level of achievement by simply identifying potential conflicts. To advance to higher levels of achievement, the project team must address these conflicts. The highest level of achievement (conserving) requires structural change of the potential conflicts.

3.2.1.4 Potential Credit Application

The potential applications of this credit are vast and will vary by region and project type. Some examples of potential conflicts are provided below:

- Some states classify types of green infrastructure as needing a permit for underground injection.
- Many regulations are in place for the reuse of municipal wastewater. Direct potable reuse would require structural change to existing regulations.
- Retention of stormwater/rainwater in general is in conflict with some western State water laws. For example, rainwater harvesting is still subject to significant restrictions in Colorado.
- EPA Region 1 uses flow-based TMDL's, but these have not been allowed in other regions.
- Inconsistency of MEP standard for MS4 programs with regard to retention requirements
- Land application or reuse of Biosolids.
- Watershed-based trading programs for nutrients
- Amending EPA TMDL regulations and guidance to incorporate adaptive management
- Revising the EPA sludge incineration rule to exclude sludge incinerators that use Biosolids to generate energy (UOTF)
- State legislatures should amend their RPS eligibilities to include energy recovery projects from Biosolids.

3.2.1.5 Other Information and Resources

1. The Water Resources Utility of the Future – A Blueprint for Action. NACWA/WERF/WEF.
2. WEF Energy roadmap

3.3 LD 3.3 Extend Useful Life

3.3.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

3.3.1.1 Objective

Extend a project's useful life by designing the project in a way that results in a completed works that is more durable, flexible and resilient.

3.3.1.2 Relevance

- WWT – Applicable (superior – pushing the boundaries). Flexibility and adaptability of process trains to address pending or future regulatory changes or increased flow would enhance the useful life of the asset. Processing systems are inherently subject to changes to effluent standards or expansions needed for future flow, not so much to physical obsolescence. However there are also opportunities to incorporate physically resilient construction materials and equipment to extend the useful life of the treatment facility.

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- Stormwater – Highly applicable (conserving – extending the boundaries). Flexibility to address pending or future regulatory changes would enhance the useful life of the asset. Stormwater regulations are in a state of flux, and systems are inherently subject to changes to regulatory requirements. For certain types of systems there are also opportunities to incorporate physically resilient construction materials to extend the useful life of the asset.
- Biosolids – Applicable (superior – pushing the boundaries). Physically resilient construction materials and equipment would extend the useful life of the asset. To some extent flexibility to address future regulatory changes or policy changes due to public pressures could enhance the useful life of the asset. Biosolids facilities are somewhat unique in that their longevity can be subject to policy changes due to public pressure.
- Collection System projects – Applicable (superior –pushing the boundaries). Primarily more resilient construction materials (pipelines) and equipment (pump stations) would extend the useful life of the asset. To some degree good planning will provide for future flow increases that will extent the useful life of the asset. But more often than not collection lines are renovated or replaced due to the physical wear or deterioration due to construction materials.

3.3.1.3 Relevant Actions

- Project future flows into the system and determine process needs to handle future flows and meet permit, then design around flexibility to provide maximum utilization of the asset while providing for low cost upgrade and expansion to accommodate future flow and regulatory requirements (without need to abandon existing assets). Design the project so that most of the asset can be re-used.
- Evaluate cost component adaptability to address future needs and consider longer life cycles for more adaptable components.
- Evaluate long term costs and durability of alternative materials and then specify the most resilient material for construction that provides the lowest life cycle cost, considering replacement and maintenance requirements.

3.3.1.4 Potential Credit Application

- For treatment plant construction – do not overdesign for future flows that might not happen. Instead, provide maximum flexibility and adaptabilityin the design to provide the most efficient treatment of current flows while providing low cost expansion and upgrade to handle future flows as they occur.
- Use corrosion resistant materials for collection system and biosolids projects.
- For collection system construction, design for gravity flow whenever possible – a gravity system generally can be constructed with a longer useful life than a pressure or pump station system, provided corrosion resistant materials of construction are used.

3.3.1.5 Other Information and Resources

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SECTION 3 – RESOURCE ALLOCATION

1 Resource Allocation - Materials

1.1 RA 1.1 Reduce Net Embodied Energy

1.1.1 Municipal Resource Recovery Facility

1.1.1.1 Objective

Conserve energy by reducing the net embodied energy of project materials over the project life.

1.1.1.2 Relevance

MA – Moderately applicable

Improved can be achieved with implementation of a Life Cycle Assessment (LCA). Reductions of 10-40% of net embodied energy over industry norms appear to be achievable. Reductions beyond this may be limited to a few applications.

1.1.1.3 Relevant Actions

Estimate net embodied energy (energy associated with extraction, processing, manufacturing, and transport of materials and components) of materials by means of an LCA, utilizing commonly accepted methodologies and software. Using LCA, tool implement strategies to reduce net embodied energy when compared to industry norms, while keeping in mind impacts to long term operation and maintenance and durability. Should consider the materials used in the construction of the project, as well as materials used for O+M during the life of the project (repair, ongoing operation, replacement etc). Streamlined LCAs which are less expensive and simpler to perform are acceptable. If utilizing a streamlined LCA, provide product data from manufacturers to compare one product to another.

Acceptable benchmarks that represent an "industry norm": a project alternative, the existing system to be replaced, a comparable project in size and location, or commonly required by law.

1.1.1.4 Potential Credit Application

- Use LCA to determine the net embodied energy of different chemicals for areas such as disinfection, chemical phosphorus removal, chemically enhanced primary treatment, alkalinity recovery, carbon etc and chose one with lower net embodied energy than typical.
- Consider biological phosphorus removal (additional tankage) rather than using a chemical phosphorus removal process where feasible.
- Consider rehabilitation and reuse of existing tanks and equipment vs new.
- Consider additional tankage, process with large footprint to reduce carbon use for denitrification
- Consider the feasibility to implement multiple process configurations during different times of the year to reduce chemical use when possible.
- Consider use of building materials with less embodied energy – different material, recycled, thinner etc where feasible

1.1.1.5 Other Information and Resources

1. WEF/IWA Fact Sheet – Using LCA in Envision for Wastewater Systems
2. General Reference on LCA: http://www.epa.gov/sustainability/analytics/life-cycle.htm

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3. University of Bath – Inventory of Carbon and Energy (ICE)

1.1.2 Stormwater

1.1.2.1 Objective

Conserve energy by reducing the net embodied energy of project materials over the project life.

1.1.2.2 Relevance

MA – moderately applicable

The purpose of this credit is to reduce the energy used in the design, development, construction and long-term maintenance of stormwater run-off/Collection through the use of Best Management Practices (BMPs). This credit would have direct applications to stormwater construction and maintenance practices for both buried and surface stormwater infrastructure, especially with regard to soil disturbance and reducing the need for subsoiling.

1.1.2.3 Relevant Actions

- LiDAR and other topographical technologies can provide the necessary information to limit soil disturbance and compaction.
- Estimate net embodied energy (energy associated with extraction, processing, manufacturing, and transport of materials and components) of materials by means of an LCA, utilizing commonly accepted methodologies and software. Using LCA tool implement strategies to reduce net embodied energy when compared to industry norms, while keeping in mind impacts to long term operation and maintenance and durability. Should consider the materials used in the construction of the project, as well as materials used for O+M during the life of the project (repair, ongoing operation, replacement etc).

1.1.2.4 Potential Credit Application

- Implementation of a low-impact design would limit the need for energy-intensive techniques during construction. Reuse of all excavated materials on-site and limiting the amount of material brought from an off-site source would be an example of a conserving practice.
- Utilize surface features to manage (convey, store, treat, infiltrate, evapotranspirate, and reuse) stormwater and reduce need for construction of buried infrastructure.
- Use native and climate-adapted vegetation for landscaping of surface stormwater system, as opposed to high-maintenance turf grass, to reduce energy required for long-term maintenance.
- Balance cut and fill onsite to reduce energy for hauling of material
- Utilize materials that have been produced using Eco-friendly or green practices.

1.1.2.5 Other Information and Resources

1. Low Impact Development Handbook for the Tualatin Basin (2009) Clean Water Services (http://www.cleanwaterservices.org/PermitCenter/NewsAndResources/LIDAHandbook.aspx)
2. Low Impact Development Center (http://www.lowimpactdevelopment.org/)
3. Stormwater Case Studies, American Society of Landscape Architecture (http://www.asla.org/stormwatercasestudies.aspx)

1.2 RA 1.2 Support Sustainable Procurement Practice

1.2.1 Municipal Resource Recovery Facility

1.2.1.1 Objective

To obtain materials and equipment from manufacturers and suppliers who implement sustainable practices.

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1.2.1.2 Relevance

MA – Moderately applicable

Although challenges arise when attempting to specify specialty equipment in concert with its manufacturer's sustainability practices, there are a growing number of companies that employ these practices, and readily publish that information on their website and available literature.

1.2.1.3 Relevant Actions

Establish sustainable procurement practice and provide evidence that shows the policy and criteria for supplier identification and selection. Document weight or cost of material meeting criteria vs total. Use of materials that are certified as sustainable by third party organizations and ensuring supplier integrity is a plus.

1.2.1.4 Potential Credit Application

- Use of by-products (e.g. manufacturing, power plants) as raw materials for concrete
- Require concrete manufacturers to indicate measures taken to reduce air pollutants during manufacture
- When applicable/permissible to project, specify piping (e.g. ductile iron, HDPE) with high percentage of recycled content
- Specify manufacturers that demonstrate utilization of sustainable practices, implement an Environmental Management System (EMS) consistent with ISO 14001 (or equivalent), and publicly disclose any unintentional chemical residuals or impurities present at or above concentrations of 100 ppm
- Utilize third party certifications (e.g. SMaRT, Energy Star) for verification of product performance
- Require manufacturers to provide evidence of material source origin, material type percentages (by weight), and percent recycled vs. virgin materials.

1.2.2 Biosolids

1.2.2.1 Objective

Obtain materials and equipment from manufacturers and suppliers who implement sustainable practices.

1.2.2.2 Relevance

MA – Moderately applicable

Solid processing facilities can incorporate substantial quantities of materials and equipment to which the goals of this credit may be applicable. Since the credit calculations are based on weight or volume of materials (although materials cost can be used), the primary focus will be construction materials employed in tankage and buildings.

1.2.2.3 Relevant Actions

Investigate opportunities for developing material and equipment specifications that incorporate provisions for sustainable practices by suppliers. Specifically, these would include these criteria:

- Have reduced negative environmental impacts by implementing an Environmental Management System consistent with ISO 14001 or equivalent.
- Have publicly disclosed all intentionally added chemical constituents and all unintentional chemical residuals or impurities present at 100 ppm or more.

1.2.2.4 Potential Credit Application

The credits criteria and levels of achievement described in the Envision Guidance Manual are directly applicable to this category

1.2.2.5 Other Information and Resources

1. Adapted from The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 5.10: Support sustainable practices in materials manufacturing.
2. CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Sections 1.3, 8.3.1, 8.3.2.

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3. U.S. Environmental Protection Agency, Environmentally Preferable Purchasing, http://www.epa.gov/oppt/epp/pubs/products/construction.htm

1.2.3 Stormwater

1.2.3.1 Objective

Obtain materials and equipment from manufacturers and suppliers who implement sustainable practices.

1.2.3.2 Relevance

MA – Moderately applicable

This credit is applicable in the procurement of many proprietary products, such as porous pavements, filters and piping.

1.2.3.3 Relevant Actions

1.2.3.4 Potential Credit Application

- Utilization of the EPA's Environmentally Preferable Purchasing (EPP) or other sustainable contract language, specifications and/or policies will help ensure that all purchased materials during the life of a project will be safe for environmental use by government entities. Additionally, any private stormwater contractor can use the provided EPP database to certify that all materials are sustainable products.
- Procure companies that train, support and hire with the intent of positively impacting economically impoverished and underserved communities.

1.2.3.5 Other Information and Resources

1. Granite Park office complex in Plano, TX (http://epa.gov/watersense/commercial/docs/watersense_at_work/#/289/zoomed)
2. WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities (2012) Environmental Protection Agency (http://epa.gov/watersense/commercial/docs/watersense_at_work)

1.3 RA 1.3 Use Recycled Material

1.3.1 Municipal Resource Recovery Facility

1.3.1.1 Objective

Reduce the use of virgin materials and avoid sending useful materials to landfills by specifying reused materials, including structures, and material with recycled content.

1.3.1.2 Relevance

A – Applicable

The application of this credit will be very project specific. The points for this credit are more easily achieved, the plant is being upgraded to meet different permit requirements or water quality objectives as compared to a plant expansion which requires additional plant capacity.

1.3.1.3 Relevant Actions

Identify and document structures and equipment on site that can be reused. Attempt to reuse existing tanks and equipment to the extent possible. If demolishing a structure or components of the plant, attempt to recycle materials for other purposes. Use recycled materials where possible. Calculate project materials recycled vs total.

1.3.1.4 Potential Credit Application

- Reuse existing structures
- During plant upgrade select process and equipment to utilize as much as the existing tankage and equipment as feasible. Eg. Rerate of existing aeration basins to allow for use of a portion as anoxic or anaerobic. Another example of this is converting existing clarifiers to sludge storage facilities, etc.

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- Use demolished concrete from site as fill material
- Use of recycled material purchased or obtained offsite in construction – eg. reused pipe or valves etc where appropriate
- Use recycled concrete for yard piping bedding, where appropriate.

1.3.1.5 Other Information and Resources

1.3.2 Stormwater

1.3.2.1 Objective

Reduce the use of virgin materials to avoid sending useful materials to landfills by specifying reused materials, including structures, and material with recycled content.

1.3.2.2 Relevance

MA – Moderately applicable
This credit has direct applicability to many of the porous pavers used in the design of permeable surfaces for parking lots and other similar areas.

1.3.2.3 Relevant Actions

During the planning and design phase, efforts should be made to determine if any local or regional manufacturers produce material with recycled objects. This will ensure supply and timely deliver for the construction phase of the project and will also keep transportation of materials to a minimum.

1.3.2.4 Potential Credit Application

Store onsite materials, such as topsoil, trees, etc. during construction and reuse.

1.3.2.5 Other Resources and Information

1. City of Chicago Green Alleys (http://www.cityofchicago.org/city/en/depts/cdot/provdrs/street/svcs/green_alleys.html)
2. EPA. Environmentally Preferable Purchasing Program. (http://www.epa.gov/epp/)

1.4 RA 1.4 Use Regional materials

1.4.1 Collection

1.4.1.1 Objective

Minimize transportation costs and impacts and retain regional benefits through specifying local sources.

1.4.1.2 Relevance

MA – Moderately applicable
In construction of collection system infrastructure, the sourcing of materials such as pipes, pumps, fittings, precast structures, concrete, brick and block provides the opportunity for local and regional sourcing. Ancillary landscaping or fill material could also apply, as well as materials used in construction for erosion control and implementation of the storm water pollution prevention plan (SWPPP). While this is not part of the design criteria for a collection systems project, it is an opportunity for sustainable procurement and construction.

1.4.1.3 Relevant Actions

Assess the planned or utilized materials, cost, and distance to the supplier. For a project in design, review the opinion of probable cost and distance to available suppliers. For a project in construction phase, review the bid tab and distance to specified suppliers. For a project in the O&M phase, review the estimate of replacement cost and distance to the material supplier of the built infrastructure. Compare the distance to the RA1.4 thresholds and calculate the % of the total cost that is sourced regionally.

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1.4.1.4 Potential Credit Application

- The most likely materials to be evaluated from a collection system project are pipes, aggregate and fill, concrete and block for structures. The following table can be utilized to support credit scoring:

Material	Distance Threshold (miles)	Within Threshold Distance ?	Material Cost	% of Total Cost
Soils & Mulches	50	Y / N		
Aggregates & Sands	50	Y / N		
Concrete, Brick & Block	100	Y / N		
Other – Pipe	100	Y / N		
Other (Specify)	500	Y / N		
Overall	-	-		

1.4.1.5 Other Information and Resources

1. (BedZED), UK - Brick & Block from sources 20-45 miles away. Beddington Zero Fossil Energy Development. http://www.bioregional.com/news-views/publications/bedzed-toolkit-for-carbon-neutral-developments-part-1-construction-materials-report/
2. Scotland's National Area, Glasgow - drainage and pipeline materials from 5 miles away. http://www.wrap.org.uk/content/logistics-case-study-scotland%E2%80%99s-national-arena-glasgow

1.4.2 Municipal Resource Recovery Facility

1.4.2.1 Objective

Percentage of project materials by type and weight or volume sourced within the required distance.

1.4.2.2 Relevance

MA – Moderately applicable

Locally sourcing plants, aggregate, sand, soil, and most materials for construction should be readily available. Foundation/geological modifications should use locally sourced materials. Distance which is considered "local" varies for the type of material, but is not extremely limiting in most metros.

1.4.2.3 Relevant Actions

Assess whether it is feasible to use locally sourced project materials based on project location and extra fees associated with using local materials. Determine in the materials meet the product standards required by project specifications.

1.4.2.4 Potential Credit Application

- Equipment that is essential to wastewater treatment should not be factored in – the most efficient equipment should be selected.
- Locally source backfill for foundations, concrete aggregate for tank walls, buildings, etc.
- Decorative plants should be locally brought in.
- Steel and structural materials may be sourced from as far as 500 miles but local materials are preferred. Mechanical, electrical and plumbing components and other specialty equipment are excluded from this credit application.
- Electrical, mechanical, and plumbing materials should not be factored into the implementation of this credit.

1.4.2.5 Other Information and Resources

1. U.S. Green Building Council – Regional Materials: 10% Extracted, Processed & Manufactured Regionally – Guidance (2012).

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2. LEED – Regional Materials Credit Guidance (2009).

1.4.3 Stormwater

1.4.3.1 Objective

Minimize transportation costs and impacts and retain regional benefits through specifying local sources.

1.4.3.2 Relevance

MA – Moderately applicable

This credit is applicable to the use of regional materials in the construction of stormwater facilities, as well as, any materials used during the long-term maintenance.

1.4.3.3 Relevant Actions

During the specification of any stormwater designs regional materials should be sourced as early in the design process as possible to ensure proper supply is available at the time of construction. For example, this may include native and adaptive plants that provide the added benefit of lower water requirements.

1.4.3.4 Potential Credit Application

- Identify local projects that may have usable unwanted construction waste (crushed rock, excavated usable soils, etc.)
- Utilizing low maintenance local plantings

1.4.3.5 Other Information and Resources

1. Water Environment Federation, Energy Roadmap: Driving Water and Wastewater Utilities to More Sustainable Energy Management (2012).

1.5 RA 1.5 Divert Waste From Landfills

1.5.1 Municipal Resource Recovery Facility

1.5.1.1 Objective

Reduce waste, and divert waste streams away from disposal to recycling and reuse.

1.5.1.2 Relevance

MA – Moderately applicable

Although there may be difficulties associated with practical reuse of specialized process equipment (e.g. blowers, mixers, diffusers, etc.) to avoid their disposal into a landfill, reuse of some other materials can be readily utilized.

1.5.1.3 Relevant Actions

Establish sustainable procurement practice and provide evidence that shows the policy and criteria for supplier identification and selection. Document weight or cost of material meeting criteria vs total. Use of materials that are certified as sustainable by third party organizations and ensuring supplier integrity is a plus.

1.5.1.4 Potential Credit Application

- Demolished or waste concrete can be recycled, and reused for a number of purposes: aggregate for new road base (concrete or asphalt), course aggregate for new concrete mix, pipe bedding, soil stabilization, drainage rip rap, landscaping materials
- Structural rebar from demolished concrete can be 100% recycled for new rebar
- Demolished ductile iron pipe can be 100% recycled for new ductile iron pipe
- Salvage of whole or partial mechanical components for aftermarket reuse, or shelved for emergency facility back-up

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- Employment of struvite recovery processes[1] in high-strength sidestreams (e.g. centrate) to divert disposal of phosphorus compounds in landfilled chemical precipitate ($AlPO_4$)
- Employment of biological phosphorus removal in lieu of chemical precipitation ($AlPO_4$), thus reducing chemical solids landfill disposal
- In lieu of complete replacement, rehabilitation of existing process equipment in order to extend useful life
- Utilization of process recycling services (e.g. UV bulbs)
- Reuse of existing tankage and equipment
- Consider resource recovery of select wastewater constituents that prevent landfill disposal.

1.5.1.5 Other Information and Resources

1. An example of struvite recovery technology is Ostara - http://www.ostara.com/

1.5.2 Biosolids

1.5.2.1 Objective

Reduce waste and divert waste streams away from disposal to recycling and reuse.

1.5.2.2 Relevance

HA – Highly applicable

There are a number of opportunities and pathways to divert waste from landfills (e.g. land application on farms, commercial fertilizer, mine and land reclamation, energy generation) depending on the biosolids treatment process and the biosolids produced.

1.5.2.3 Relevant Actions

Determine the final disposal pathways available, such as beneficial reuse customers or energy companies to process the biosolids into energy, and develop of a diverse and flexible biosolids management program with multiple land application and final disposal options. Design the treatment process so that the produced biosolids meet state and federal standards, in which a significant amount of the biosolids is beneficially reused.

1.5.2.4 Potential Credit Application

- Incorporate any of the following treatments noted in 40 CFR Part 503[1] to produce a Class A or Class B biosolids, which can be beneficially reused. Beneficial reuse includes land application to farms, use for land reclamation, production of commercial grade fertilizers, etc.
- Incorporate a treatment process to produce a dry pellet that can be used as fuel.
- Construct anaerobic digesters to take in food waste, which diverts the disposal of the food wastes at landfill sites.
- Incorporate the gasification treatment process to convert the biosolids into thermal energy.

1.5.2.5 Other Information and Resources

1. 40 Code of Federal Regulations Part 503, Standards for the Use or Disposal of Sewage Sludge United States Environmental Protection Agency (USEPA)
2. Kearney, R.; Bolin, K., The new SlurryCarb process under construction in Rialto, CA will convert biosolids to a renewable fuel, Water Environment Federation (WEF) Residuals and Biosolids Conference Proceedings, Philadelphia, PA (2008).
3. WEF, Land Application and Composting of Biosolids Q&A Fact Sheet (2010)
4. WEF, Enabling the Future: Advancing Resource Recovery from Biosolids (2013)
5. WEF, Energy Roadmap: Driving Water and Wastewater Utilities to More Sustainable Energy Management (2012).
6. National Association of Clean Water Agencies (NACWA), Renewable Energy Resources: Banking on Biosolids (2010).

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7. USEPA, Office of Wastewater Management, Emerging Technologies for Biosolids Management, EPA 832-R-06-05, Page 1-1. (2006).
8. USEPA, Combined Heat and Power Partnership, Opportunities for and Benefits of Combined Heat and Power at Wastewater Treatment Facilities (2006).

1.5.3 Stormwater

1.5.3.1 Objective

Reduce waste, and divert waste streams away from disposal to recycling and reuse.

1.5.3.2 Relevance

MA – Moderately applicable

The purpose of this credit is to reduce the amount of material removed during the construction of stormwater facilities.

1.5.3.3 Relevant Actions

1.5.3.4 Potential Credit Application

- Identify other projects that may be able to utilize project wastes

1.5.3.5 Other Information and Resources

1. Office of Sustainability and the Environment. Construction Management: Material Conservation. City of Santa Monica (http://www.smgov.net/Departments/OSE/Categories/Green_Building/Guidelines/Construction_Management/Material_Conservation.aspx)

1.6 RA 1.6 Reduced Excavated Materials Taken Offsite

1.6.1 Municipal Resource Recovery Facility

1.6.1.1 Objective

Minimize the movement of soils and other excavated materials off site to reduce transportation and environmental impacts.

1.6.1.2 Relevance

A - Applicable for new construction or other construction requiring excavation and transport of excavated material.

1.6.1.3 Relevant Actions

Design (and document) to balance Cut and Fill to reduce excavated material taken offsite.

1.6.1.4 Potential Credit Application

- Prior to construction, geotechnical evaluation will conclude if soil has suitable bearing capacity and the potential for soil expansion. If the underlying soil is suitable, the overburden is typically removed to a depth where suitable material is available. In the case of expansive clays, the geophysical properties can sometimes be modified by the careful incorporation of modifying agents such as lime. The possible use of modifying agents can reduce the amount of excavated material taken off site.
- Upper soils with poor bearing capacity are often stripped and replaced with properly compacted select fill. An alternate strategy is to construct foundations on pilings. Pilings are normally only considered after an economic analysis weighing the expense of excavation and replacement with select compacted fill versus the expense of construction on pilings.
- Construction of low profile plants causes considerable excavation for wastewater treatment structures. Construction of higher profile plants (i.e. further out of the ground) reduces excavation.
- If material must be excavated, construction of a berm can sometimes be considered, if there is enough property available at the treatment plant. A berm can

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help: hide the facility; provide sound blocking; and be landscaped to improve visual improvements.

1.6.1.5 Other Information and Resources

1. Miller, D. J., Nelson, J. D. (1992). Expansive Soils: Problems and Practice in Foundation and Pavement Engineering, John Wiley & Sons, Inc., Toronto, Canada

1.6.2 Stormwater

1.6.2.1 Objective

Minimize the movement of soils and other excavated materials off site to reduce transportation and environmental impacts.

1.6.2.2 Relevance

MA – Moderately applicable

This credit has applicability to the removal, disposal and addition of soils necessary during the construction phase, as well as, any native vegetation on-site.

1.6.2.3 Relevant Actions

- LiDAR and GIS

1.6.2.4 Potential Credit Application

- Using low-impact design strategies will reduce the need for soil restoration. Typically, compaction from mechanical equipment in the construction proves will impair the infiltration properties of native soils and require restoration to regain the hydraulic properties. Identify during design methods to reuse soils on site.

1.6.2.5 Other Information and Resources

1.7 RA 1.7 Provide for Deconstruction and Recycling

1.7.1 Collection

1.7.1.1 Objective

Encourage future recycling, up-cycling, and reuse by designing for ease and efficiency in project disassembly or deconstruction at the end of its useful life.

1.7.1.2 Relevance

MA – Moderately applicable

Although there may be difficulties associated with practical deconstruction of underground pipe, components of pump stations, diversion structures, etc. should be able to be disassembled and recycled at the end of their useful life. The structure itself may also be repurposed at the end of its useful life.

1.7.1.3 Relevant Actions

- Assess whether materials specified can be easily recycled or reused after the useful life of the project has ended.
- Design the project so that a significant amount of project materials can be easily separated for recycling or readily reused at the end of the project's useful life.
- Incorporate methods for increasing the likelihood of materials recycling when the project is operating.

1.7.1.4 Potential Credit Application

% components that can be easily separated for reuse or recycling (by weight or cost of materials)

Improved	Enhanced	Superior	Conserving
15-30%	30-50%	50-75%	>75%

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1. Demolished or waste concrete can be recycled, and reused for a number of purposes: aggregate for new road base (concrete or asphalt), course aggregate for new concrete mix, pipe bedding, soil stabilization, drainage rip rap, landscaping materials
2. Structural rebar from demolished concrete can be 100% recycled for new rebar
3. Demolished ductile iron pipe can be 100% recycled for new ductile iron pipe
4. Demolished PVC pipe can be 100% recycled for new PVC pipe
5. Salvage of whole or partial mechanical components for aftermarket reuse, or shelved for emergency facility back-up
6. In lieu of complete replacement, rehabilitate equipment in order to extend useful life
7. Design structures so that they may be repurposed at the end of their useful life

1.7.1.5 Other Information and Resources

1. Concrete Recycling: http://www.concreterecycling.org/how.html
2. Ductile Iron Pipe Recycling: http://www.clowwatersystems.com/environment-health-safety/sustainability-for-generations/sustainable-products/
3. PVC Pipe Recycling: http://www.pvc.org/en/p/sustainability
4. Structure Reuse: http://www.gbateam.com/news-acec-sewer-improvements.html
5. http://www.archi-ninja.com/excellent-examples-of-adaptive-reuse/
6. http://www.fastcodesign.com/1665804/old-sewage-treatment-plant-will-become-a-huge-rock-climbing-wall#3
7. http://freshome.com/2012/02/25/uk-water-pumping-station-converted-into-sophisticated-modern-home/

1.7.2 Municipal Resource Recovery Facility

1.7.2.1 Objective

Encourage future recycle, up-cycling, and reuse by designing for ease and efficient project disassembly or deconstruction at the end of its useful life.

1.7.2.2 Relevance

MA – Moderate Applicability

1.7.2.3 Relevant Actions

Inventory materials incorporated into design that retain value for future use and document the percentage that is estimated to be recycled vs total materials. Also, designs such that future disassembly and recycling of materials is facilitated.

1.7.2.4 Potential Credit Application

- Prior to construction, equipment selection will conclude if equipment has possibility of recycling. Large equipment such as belt presses and gravity belt thickeners can sometimes be refurbished. Other large equipment such as clarifiers can be sold as scrap metal.

1.7.2.5 Other Information and Resources

1.7.3 Stormwater

1.7.3.1 Objective

Encourage future recycling, up-cycling, and reuse by designing for ease and efficiency in project disassembly or deconstruction at the end of its useful life.

1.7.3.2 Relevance

MA – Moderately applicable

This credit is applicable to any stormwater projects that requires the use of materials to facilitate the completion of the construction phase (i.e. gravel roadways, temporary structures, etc…).

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1.7.3.3 Relevant Actions

- All materials not needed after the final completion date of a project should be identified and recovered for future use.

1.7.3.4 Potential Credit Application

- Construction and Debris Analysis

1.7.3.5 Other Information and Resources

1. Kevin M. Flynn, Robert G. Traver, Green infrastructure life cycle assessment: A bio-infiltration case study, Ecological Engineering, Volume 55, June 2013, Pages 9-22, (http://www.sciencedirect.com/science/article/pii/S0925857413000190)
2. Lim, Myungkwan; Choi, Heesup; Choi, Hyeonggil; Kitagaki, Ryoma; Noguchi, Takahumi, Development of Eco-Friendly Deconstruction Technologies for Recycling Construction Waste, Journal of Environmental Protection, Volume 5, Issue 7, May 2014, Pages 647-661

2 Resource Allocation- Energy

2.1 RA 2.1 Reduce Energy Consumption

2.1.1 Collection

2.1.1.1 Objective

Conserve energy by reducing overall operation and maintenance energy consumption throughout the project life cycle.

2.1.1.2 Relevance

MA – Moderately applicable
Some wastewater collection systems are gravity-only systems that may not have physical characteristics amenable to adding hydropower generation facilities. Some wastewater collection systems may only have a limited number of lift stations and none that are housed in occupied buildings requiring heating or air conditioning due to human habitation. Few totally new collection systems are being implemented with most projects connecting to existing collection systems.

2.1.1.3 Relevant Actions

Carefully site new collection system sewers and lift stations to maximize gravity flow and minimize pumping requirements. Evaluate sewer hydraulics to minimize the need for chemical feeds for odor control or for fats, oils and grease control. Assess whether sewer hydraulics allow for electrical or mechanical energy from hydropower. Consider the potential for solar radiation or wind power capture for ancillary power at lift stations or remote metering sites.

Consider the installation of "green infrastructure" facilities to manage storm water and, to the extent possible, to divert storm water flows from the separated or combined sewer systems. For existing systems, also consider programs for infiltration/inflow (I/I) reduction to reduce energy consumption associated with wastewater Collection and treatment.

2.1.1.4 Potential Credit Application

- Maximize use of gravity sewers rather than pumped conveyance by proper siting and design slope design decisions
- Generate electrical or mechanical energy from sewer hydropower sources
- Minimize usage of chemical feeds for odor control or for fats, oils and grease control by proper gravity sewer hydraulics
- Minimize pump head requirements through appropriate site selection
- Utilize high-efficiency equipment

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- Capture solar radiation at lift station sites for ancillary power
- Capture wind power at lift station sites for ancillary power
- Shield lift station buildings with landscape vegetation in order to reduce heating and cooling needs for occupied portions of the buildings

2.1.1.5 Other Information and Resources

1. Possible technologies:
   - Energy Systems and Design – Model LH 1000
   - Power Pal – Model MHG 1000LH
   - Canyon Hydro-Kaplan Turbine
   - Toshiba International-Hydro-eKIDs
   - VLH Turbine
   - HydroCoil
2. Project examples or case studies:
   - Point Loma, San Diego, California
   - Kankakee, Illinois
   - Deer Island, Boston, Massachusetts
3. USEPA, Renewable Energy Fast Sheet: Low Head Hydropower from Wastewater. (2013 Accessed May 29, 2014 from http://water.epa.gov/scitech/wastetech/upload/Low-Head-Hydropower-from-Wastewater.pdf
4. Water Environment Federation Board of Trustees, WEF Position Statement, Renewable Energy Generation from Wastewater (2011).
5. Water Environment Federation, Energy Roadmap: Driving Water and Wastewater Utilities to More Sustainable Energy Management (2012).

2.1.2 Municipal Resource Recovery Facility

2.1.2.1 Objective

Conserve energy by reducing overall operation and maintenance energy through the project life cycle.

2.1.2.2 Relevance

HA – Highly Applicable

As new emergent technologies are born to reduce energy consumption, they can be applied where and when possible to reduce the overall energy consumption of the water reclamation process. Finding and utilizing new technology or improving an existing technology or the water reclamation process, as applied to specific equipment may result in increased levels of achievement for this subcategory. Benchmark: Utilizing the existing project set of conditions, an alternative project or a comparable project in size, location and intent, as the baseline industry standard benchmark improvements to measure the reduced energy consumption. Must meet the basic code and regulatory requirements in regard to energy consumption. Performance improvement: Specify energy efficient equipment and processes and incorporate systems level thinking early in the design process to re-evaluate energy needs and processes and significantly reduce energy consumption throughout the project as compared to the original design or existing project.

2.1.2.3 Relevant Actions

- Initiate an assessment of the system to determine the energy consumption. Identify any energy saving targets. The Life Cycle Analysis (LCA) is important to determine the overall energy deficiencies.
- Develop a list of energy deficits and create a plan to mitigate the energy losses across the wastewater processes or system
- Document relevant technologies to reduce energy consumption.
- Document energy savings

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Provide designs that save energy over the life cycle of the equipment or water reclamation system. The anticipated operation and maintenance energy consumption on an annual basis for the life of the project. For credit RA2.1 special attention should be given to the levels of energy consumption compared to original usage. The calculations of the project's annual energy consumption to achieve a reduction in operational energy over the industry norms should be significant and measurable.

2.1.2.4 Potential Credit Application

- Optimize Aeration: The old rule of thumb of keeping DO at 2.0 in all portions of the aeration basins is wasteful. Effective treatment can be achieved with less air. Transfer efficiency is also increased when the DO concentration is lowered. Implement a blower control strategy (preferably automatic) to reduce air use. Consider using advanced control strategies, which utilize ammonia concentration or ammonia versus NOX to reduce air use as much as possible and encourage simultaneous nitrification denitrification, nitrite shunt, or anammox.
- Optimize Mixing: Do not let mixing limitations of aeration system define the lower operating points of aeration turndown. It may be found that using advanced control strategies will not provide enough air under certain circumstances. Diffuser selection and installation pattern will set minimum airflow, however intermittent aeration can be used to provide adequate air to allow diffusers to operate when air is flowing. If cycles are kept at a small and specific timeframe and the biomass can be kept in suspension. If the timeframe is too great the mixing is not ensured. Consider decoupling mixing from aeration by providing mechanical mixers or pulsed bubble aeration.
- Potential Aeration systems control of the air supply to the biological process can reduce the energy used at the facility.
- Use energy efficient blowers and diffusers. Blowers Selection, Dependent on Process, and Plant Size: Multi Stage Centrifugal (Single Speed or VFD Controlled), Positive Displacement Rotary Lobe, High Speed Turbo Blowers, Screw Centrifugal Blowers. For smaller plants, a single blower or pair of blowers with a great amount of turn down is often best provided by a turbo blower or screw centrifugal blower.
- Implement swing zones with mixers to operate as anoxic during warmer temperatures to reduce energy
- Consider denitrification as a way to reduce energy even if not required for permit requirements
- Aeration control based on DO, ORP, nutrients
- Cogeneration/digestion, co-digestion
- DO control modifications, aeration, anaerobic, anammox, UV, Sludge handling,
- More efficient mixers/pumps; VFD's and "right" sizing of the pumps is beneficial to reducing energy consumption.
- Filed Instrumentation: Bioluminescent DO Probes, Ion Selective Probes (Ammonia, Nitrate, Nitrite), Optical Probes
- Combined Heat and Power (CHP)
- Co-digestion for additional gas and power generation
- Reduction of Infiltration/Inflow (I/I) to reduce pumping/treatment requirements of wastewater treatment plant

2.1.2.5 Other Information and Resources

1. Water Environment Federation, Energy Roadmap: Driving Water and Wastewater Utilities to More Sustainable Energy Management (2012).
2. U.S. EPA's September 2010 publication titled "Evaluation of Energy Conservation Measures for Wastewater Treatment Facilities" outlines several methods ranging from simple to advanced control.

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3. Opportunities for and Benefits of Combined Heat and Power at Wastewater Treatment Facilities" [U.S. EPA and Combined Heat and Power Partnership, April 2007].
4. The East Bay Municipal Utility District (EBMUD) in Oakland, California currently co-digests food waste and high-strength wastes along with primary and secondary municipal wastewater solids. EBMUD has pioneered significant research on the digestibility and energy production potential of various food wastes. Refer to "Anaerobic Digestion of Food Waste: Final Report". East Bay Municipal Utility District. March 2008.
5. National Renewable Energy Laboratories (NREL), Energy Efficiency Strategies for Municipal Wastewater Treatment Facilities (2012)
6. New York State Energy Research & Development Authority (NYSERDA), Water & Wastewater Energy Management – Best Practices Handbook (2010)

2.1.3 Biosolids

2.1.3.1 Objective

Conserve energy by reducing the overall operation and maintenance energy consumption throughout the project life cycle.

2.1.3.2 Relevance

HA – Highly applicable
Biosolids processing is often an energy intensive process and lends itself to numerous opportunities and pathways to reduce energy consumption through various stages (i.e. dewatering, drying, stabilization, transport, land application).

2.1.3.3 Relevant Actions

Site new facilities in order to minimize transporting biosolids until the maximum solids concentration has been obtained. Maximize the use of ambient conditions (wind and solar energy) to supplement the drying process. Capture and beneficially reuse waste heat generated from other systems to supplement the drying process, and beneficially reuse any excess heat generated during biosolids treatment for other on-site heating needs.

2.1.3.4 Potential Credit Application

- Maximize the use of the sun for drying biosolids
- Use fuel efficient vehicles for transporting biosolids
- Use waste heat from other processes to increase drying rate
- Use waste heat generated during biosolids processing to offset other energy demands
- Incorporate vegetation with a high water-uptake to aid in drying biosolids

2.1.3.5 Other Information and Resources

1. Possible technologies:
   a. Low-Temperature-Assisted Thermal Drying Beds (i.e. Parkson Thermo-System)
   b. Brown Bear Compost Turner
   c. Electric Engines for transport vehicles
   d. Heat exchangers
2. Project examples or case studies:
   a. The Crawford, Nebraska WWTP used Reed Bed Dewatering.
   b. Pinetop Lakeside Sanitary District, AZ – Compost facility
3. USEPA, Office of Wastewater Management, Emerging Technologies for Biosolids Management, EPA 832-R-06-05, Page 1-1. (2006).
4. Water Environment Federation, Energy Roadmap: Driving Water and Wastewater Utilities to More Sustainable Energy Management (2012).

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2.2 RA 2.2 Use Renewable Energy

2.2.1 Municipal Resource Recovery Facility

2.2.1.1 Objective

Use alternative or renewable energy sources for energy consumption.

2.2.1.2 Relevance

HA – Highly Applicable

Net Zero energy use is the overall goal. Renewable energy can be utilized to reduce the consumption of traditional fossil fuels for operation of equipment and water reclamation system facilities. Benchmark: Renewable energy sources do not exceed 10% of the project's annual anticipated energy consumption. Performance improvement: Increase use of renewable energy sources whenever practical and decrease overall energy needs.

2.2.1.3 Relevant Actions

- Identify the energy requirements, and benchmark current energy usage and sources.
- Create a plan to replace existing fossil fuel energy sources with alternative renewable energy sources.
- Document relevant renewable energy technologies.
- Document renewable energy savings and actions.
- Provide alternative renewable energy designs that replace existing fossil fuel uses for the equipment or wastewater system. The anticipated energy consumption should be broken down by source and type to reflect the overall energy savings of the wastewater operation. The overall renewable energy consumption and percentage of savings should be documented of total renewable energy savings vs. the overall energy used.

2.2.1.4 Potential Credit Application

- Identify the energy requirements, and benchmark current energy usage and sources.
- Create a plan to replace existing fossil fuel energy sources with alternative renewable energy sources.
- Document relevant renewable energy technologies.
- Document renewable energy savings and actions.
- Provide alternative renewable energy designs that replace existing fossil fuel uses for the equipment or wastewater system. The anticipated energy consumption should be broken down by source and type to reflect the overall energy savings of the wastewater operation. The overall renewable energy consumption and percentage of savings should be documented of total renewable energy savings vs. the overall energy used.

2.2.1.5 Other Information and Resources

1. Water Environment Federation, Energy Roadmap: Driving Water and Wastewater Utilities to More Sustainable Energy Management (2012).
2. U.S. EPA's September 2010 publication titled "Evaluation of Energy Conservation Measures for Wastewater Treatment Facilities" outlines several methods ranging from simple to advanced control.
3. Opportunities for and Benefits of Combined Heat and Power at Wastewater Treatment Facilities" [U.S. EPA and Combined Heat and Power Partnership, April 2007].
4. The East Bay Municipal Utility District (EBMUD) in Oakland, California currently co-digests food waste and high-strength wastes along with primary and secondary municipal wastewater solids. EBMUD has pioneered significant research on the digestibility and energy production potential of various food wastes. Refer to "Anaerobic Digestion of Food Waste: Final Report". East Bay Municipal Utility District. March 2008.
5. National Renewable Energy Laboratories (NREL), Energy Efficiency Strategies for Municipal Wastewater Treatment Facilities (2012)

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6. New York State Energy Research & Development Authority (NYSERDA), Water & Wastewater Energy Management – Best Practices Handbook (2010)
7. CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Sections 7.1.1, 7.1.2.

2.2.2 Biosolids

2.2.2.1 Objective

Meet energy needs through renewable energy sources.

2.2.2.2 Relevance

A – Applicable

There are a significant number of opportunities to generate renewable energy through certain biosolids management processes (i.e. gasification, biogas cogeneration, biogas conversion to fuel).

2.2.2.3 Relevant Actions

Determine the final disposal pathway and end users of the biosolids, and then evaluate the feasibility for generating renewable energy through biosolids processing to increase the portion of operational energy that comes from renewable energy resources.

2.2.2.4 Potential Credit Application

- Generate electricity from processing biosolids
- Generate alternative fuel from processing biosolids
- Codigestion of high strength organics to increase biogas generation and subsequent cogeneration

2.2.2.5 Other Information and Resources

1. Possible technologies:
    a. Low-Temperature-Assisted Thermal Drying Beds (i.e. Parkson Thermo-System)
    b. Biogas cogeneration technologies (i.e. internal combustion engines, microturbines, fuel cells)
    c. Biogas processing technologies that produce fuels such as CNG
    d. Gasification
    e. SlurryCarb Pyrolysis
2. Project examples or case studies:
    a. The Orange County Sanitation District in California treats a flow of 213 mgd and generates 9.3 megawatts (MW) of power using biogas.
    b. At an average plant flow of 130 mgd, the Metro Wastewater Reclamation District in Denver, Colorado, generates up to 5 MW supplying 40 percent of the treatment plant's total electrical needs.
    c. Cell lysing sludge pretreatment technologies include thermal hydrolysis, mechanical disintegration and electrical pulse treatment.
    d. Incineration with power generation has been successfully implemented by the Metro Wastewater Treatment Plant in St. Paul, Minnesota. The plant has a 3.5 MW generation capacity, which reportedly reduces the plant's greenhouse gas emissions by approximately 18 percent on average.
    e. A gasification facility for biosolids treatment is operating in Sanford, Florida.
    f. A SlurryCarb facility is operating in Rio Alta, California.
    g. In Winterther, Switzerland, the Huber ThermWin system is being used to extract heat from wastewater to provide building heating in the adjacent Wintower Building.
3. United States Environmental Protection Agency (USEPA), Combined Heat and Power Partnership, Opportunities for and Benefits of Combined Heat and Power at Wastewater Treatment Facilities (2006).

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4. USEPA, Office of Wastewater Management, Emerging Technologies for Biosolids Management, EPA 832-R-06-05, Page 1-1. (2006).
5. Kearney, R.; Bolin, K., The new SlurryCarb process under construction in Rialto, CA will convert biosolids to a renewable fuel, WEF Residuals and Biosolids Conference Proceedings, Philadelphia, PA (2008).
6. NACWA, Renewable Energy Resources: Banking on Biosolids (2010).
7. Water Environment Federation, Energy Roadmap: Driving Water and Wastewater Utilities to More Sustainable Energy Management (2012).

2.3 RA 2.3 Commission and Monitor Energy Systems

2.3.1 Municipal Resource Recovery Facility

2.3.1.1 Objective

Ensure efficient functioning and extend useful life by specifying the commissioning and monitoring of the performance of energy systems.

2.3.1.2 Relevance

A - Applicable

Extensive initial commissioning process and long term monitoring is achievable.

2.3.1.3 Relevant Actions

Develop commissioning requirements and document in contract documents. Commissioning authority should be independent of design and construction team. Provide sufficient information and training on operation and maintenance requirements. Incorporate monitoring equipment.

2.3.1.4 Potential Credit Application

- Ensure that a commissioning plan is in place to make sure that startup of facilities is meeting planned energy usage.
- Use electrical usage data monthly to try to reduce energy usage and monitor efficiency of plat
- Install alarm systems on DCS to alert plant staff about energy overuse
- Develop a protocol to turn off unnecessary equipment and load shed during overuse of energy.
- Develop plan to ensure that pumps and other equipment are operating as efficiently as possible.
- Pump and other equipment monitoring
- DCS integration of energy monitoring
- Staff education

2.3.1.5 Other Information and Resources

1. U.S. Green Building Council – Ongoing & Monitoring Based Commissioning Guidance (2012)

2.3.2 Biosolids

2.3.2.1 Objective

Ensure efficient functioning and extend useful life by specifying the commissioning and monitoring of the performance of energy systems.

2.3.2.2 Relevance

HA – Highly applicable

Biosolids systems routinely produce methane gas used in energy generation systems. These systems often include gas conditioning, gas storage, electricity generation, and heat recovery. Biosolids handling systems are often one of the larger energy demands at a plant. Proper commissioning and monitoring of these systems, including through a plant SCADA system, will ensure their value and useful life.

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2.3.2.3 Relevant Actions

Energy systems can be complicated and complex, with many interrelated pieces of equipment. Specifying a thorough and detailed energy system commissioning will help ensure the designed efficiency and energy benefit is achieved. Monitoring of the systems using a plant SCADA or similar system enables optimal use of the system. Examples can include an Energy Dashboard and metering the production and use of energy on individual, larger pieces of equipment (often referred to as submetering).

2.3.2.4 Potential Credit Application

- Install electric meters on all major equipment and on all systems
- Provide an energy dashboard through the plant SCADA system.
- Specify a thorough, detailed commissioning requirement in the contract documents. Consider third-party commissioning.
- Measure and maximize use of waste heat from electricity generation
- Monitor and verify performance of digester gas conditioning systems

2.3.2.5 Other Information and Resources

1. Possible Technologies
    a. Gas conditioning for hydrogen sulfide, siloxanes, and moisture
    b. Gas purification systems
    c. Combined heat and power (CHP) system
    d. Heat pump
2. Project examples
    a. DC Water Biosolids Management Program
    b. Milwaukee MSD Landfill Gas Energy Pipeline and Turbine Project
    c. Janesville, Wisconsin microturbines and CNG from digester gas
3. Water Environment Federation, Energy Roadmap: Driving Water and Wastewater Utilities to More Sustainable Energy Management (2012).
4. Energy Conservation in Water and Wastewater Facilities, Manual of Practice No. 32, Water Environment Federation (2010)
5. United States Environmental Protection Agency (USEPA), Combined Heat and Power Partnership, Opportunities for and Benefits of Combined Heat and Power at Wastewater Treatment Facilities (2006)
6. Design of Municipal Wastewater Treatment Plants, Chapter 5 – Sustainability and Energy Management, Water Environment Federation (2010)
7. Renewable Energy Resources: Banking on Biosolids, National Association of Clean Water Agencies (NACWA – 2010)

3 Resource Allocation- Water

3.1 RA 3.1 Protect Freshwater Availability

3.1.1 Municipal Resource Recovery Facility

3.1.1.1 Objective

Reduce the negative net impact on fresh water availability, quantity and quality. Determine whether the project's water consumption will have a long term net negative/neutral/positive impact on quantity and quality of fresh/surface/ground/coastal waters.

3.1.1.2 Relevance

MA – Moderate Applicability

Dependent on size and scope of project, number of personnel at WRRF. May be limited to potable water demand which does not vary much through the day. Plants producing reuse water in excess of potable requirements can potentially score well on this credit.

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3.1.1.3 Relevant Actions

- Identify the water available for the project needs; in the case of a WRRF water brought on site will most likely be potable water via the municipal system.
- Assess the water requirements for construction and operation.
- Mitigate any potential impacts to quantity and quality of ground or surface water sources
- Consider opportunities for water reuse (on and/or offsite) or groundwater recharge.

3.1.1.4 Potential Credit Application

- Use in plant non potable water for washdowns etc
- Use WRRF effluent to for ground water recharge or for external reuse off site which can also recharge the groundwater, or reduce the need for withdrawals from ground water or surface water sources.
- Use landscaping on site that requires minimal watering
- Take steps to reduce run off that might impact quality of water sources

3.1.1.5 Other Information and Resources

3.1.2 Stormwater

3.1.2.1 Objective

Reduce the negative net impact on fresh water availability, quantity and quality.

3.1.2.2 Relevance

HA – Highly applicable

This credit directly applies to all stormwater facilities that reduce the quantity and/or improve the quality of all storm related run-off.

3.1.2.3 Relevant Actions

The use of stormwater facilities to reduce the quantity of storm run-off directly impacts the amount of pollutants that end up in downstream surface waters. Additionally, determining the amount of run-off and the types of pollutants in the run-off during design will give insights into the types of facilities needed to improve the quality of any run-off that does enter nearby surface waters through stormwater facilities.

3.1.2.4 Potential Credit Application

- Design of stormwater facilities should incorporate either infiltratation practices or provide a buffer to all downstream surface waters from run-off (urban, agricultural, etc..) originating from storm events in order to mitigate the net negative impacts on fresh water resources.
- Use water quality volume and other on-site measures that eliminate or minimize discharge of impacted stormwater into natural water systems

3.1.2.5 Other Information and Resources

3.2 RA 3.2 Reduce Potable Water Consumption

3.2.1 Biosolids

3.2.1.1 Objective

Reduce overall potable water consumption and encourage the use of greywater, recycled water, and stormwater to meet water needs.

3.2.1.2 Relevance

MA – Moderately applicable

Depending on where the boundaries of the biosolids system are drawn, sources of readily available recycled water may be available. Specifically, dewatering operations are normally

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located at water reclamation facilities where recycled water is typically available. This may not be the case at other locations such as composting facilities.

3.2.1.3 Relevant Actions

Assess whether recycled water achieves solids and other criteria required for use in process equipment (i.e. will nozzles clog?). Is the recycled water chlorinated to an extent that will affect the process for which it is intended (i.e. polymer make-up).

Treat reclaimed water to achieve required criteria.

- Depending on the intended use, solids inherent in wastewater stream may plug nozzles in downstream equipment. Unless only used for wash-down, minimum treatment for replacing potable water should be filtration.
- Gravity sand or mixed media filtration
- Low head, automatic backwash sand or mixed media filtration
- Cloth or mesh disk filtration
- Compressible media filtration (fuzzy filters)
- Advanced filtration (ultra-filtration, membrane filtration, reverse osmosis)
- Not generally required for reuse in plant, but other options include: walnut shell filtration for oil removal; carbon filtration for organics removal

3.2.1.4 Potential Credit Application

- At a water reclamation facility, use non-potable reclaimed water for chemical and polymer make-up when possible for dewatering
- Use non-potable reclaimed water for dewatering equipment cleaning systems and wash-down
- Use non-potable reclaimed water for wetting operations at compost facilities
- Use non-potable water for sludge drying facilities

3.2.1.5 Other Information and Resources

1. Water Reuse – Issues, Technologies, and Applications, Metcalf & Eddy/AECOM, McGraw Hill 2007.

3.2.2 Stormwater

3.2.2.1 Objective

Reduce overall potable water consumption and encourage the use of greywater, recycled water, and stormwater to meet water needs.

3.2.2.2 Relevance

HA – Highly Applicable

This credit is applicable to the selection and use of native and/or adaptive plants in stormwater facilities.

3.2.2.3 Relevant Actions

A compiled list of native or non-invasive climate-adapted plants should be used during the design of any stormwater facilities to ensure that long-term water and nutrient requirements are effectively reduced while meeting the stormwater reduction requirements of the facility.

3.2.2.4 Potential Credit Application

- Selecting native and climate-adapted plants will reduce the frequency of maintenance and lessen water requirements during the initial plant establishment period and subsequent droughts or periods of excessive heat.
- Utilize treated water from site stormwater ponds and treatment systems during construction.
- Utilized trickle irrigation and rain barrels for post construction water needs.

3.2.2.5 Other Information and Resources

1. The Chesapeake Bay Foundation's Brock Environmental Center

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3.3 RA 3.3 Monitor Water Systems

3.3.1 Municipal Resource Recovery Facility

3.3.1.1 Objective

Reduce overall potable water consumption and encourage the use of grey water, reuse water, and storm water to meet water needs.

3.3.1.2 Relevance

A - Applicable

Extensive initial commissioning process and long term monitoring is achievable. However, may not be cost effective if limited water savings can be achieved.

3.3.1.3 Relevant Actions

Develop commissioning requirements and document in contract documents. Commissioning authority should be independent of design and construction team. Incorporate metering and leak detection systems. Note how monitoring system can be used to reduce water consumption.

3.3.1.4 Potential Credit Application

- Ensure that a commissioning plan is in place to make sure that start up of facilities is meeting planned water usage.
- Use water usage data monthly to try to reduce usage
- Install leak detection system
- DCS integration of water use monitoring
- Staff education
- There is tremendous potential to gain significant points in this category for the addition of reuse water pumping and treatment to tertiary wastewater treatment plant projects.

3.3.1.5 Other Information and Resources

1. Water Recycling and Reuse: The Environmental Benefits, EPA
2. Overview of Greywater Reuse – The potential of greywater systems to aid sustainable water management, 2010, Pacific Institute

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SECTION 4 – NATURAL WORLD

1 Natural World - Siting

1.1 NW 1.1 Preserve Prime Habitat

1.1.1 Collection, Stormwater

1.1.1.1 Objective

Avoid placing the project – and the site compound/temporary works – on land that has been identified as of high ecological value or as having species of high value. Recognize and quantify trade-offs that may impact prime habitat, both directly and indirectly.

1.1.1.2 Relevance

Highly Applicable – HA

Preserves and enhances many of the ecosystem service values that contribute to the health and welfare of our communities while reducing the need for infrastructure that is costly to build and maintain.

1.1.1.3 Relevant Actions

- Avoid development in prime habitat areas
- Be aware of indirect effects of development on lands that have ecological links to prime habitats, especially barriers to migration corridors and upstream watershed alterations
- Conserve prime habitat lands in project areas and include adequate buffering with consideration to migratory corridors and overall watershed condition and carrying capacity
- Restore or allow passive recovery of habitats to strengthen and protect prime habitat values
- Recognize that preservation and natural recovery are the best management tools for prime and health habitats. Minimize disturbance footprints and conserve land to the maximum extent possible
- Recognize ecosystem service trade-offs from unavoidable development disturbance to ensure social and economic benefits are optimized and ecosystem impacts minimized

1.1.1.4 Potential Credit Application

- Ratio of prime habitat lands preserved or conserved to lands disturbed and developed
- Indirect effects to prime habitats from adjacent lands are minimized, especially migration corridors, watershed health, and adequate buffers
- Project footprint of land disturbance is minimized and natural land features, soils and vegetation are protected to the maximum extent
- Ecosystem service trade-offs are quantified and balanced in a socio-economic context at the watershed scale
- Opportunities for mitigation, restoration and recovery are taken

1.1.1.5 Other Information and Resources

1.1.2 Biosolids, Municipal Resource Recovery Facility

1.1.2.1 Objective

Avoid placing the project – and the site compound/temporary works – on land that has been identified as of high ecological value or as having species of high value.

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1.1.2.2 Relevance

HA – Highly Applicable for Infrastructure

The overall goal is to preserve or increase the area to be preserved of the land area that is identified as being highly ecological value, or prime habitat for highly ecological species.

1.1.2.3 Relevant Actions

- Identify the infrastructure project site area to prevent and minimize direct and indirect impacts to the ecological resources.
- Documentation of coordination and collaboration with state or local agencies regarding classifications or regulations regarding high ecological value land or lands supporting high-value species. Compliance with applicable regulations. Including following standards and definitions as outlined by third party organizations, such as, the Sustainable Forestry Initiative (SFI), Forest Stewardship Council (FSC), and the Canadian Standards Association (CSA).
- Document and define the infrastructure site in detail as to the extent and limits of prime habitat, including the measures to protect the ecological value of the site.
- Provide map of the buffer zones surrounding any prime habitat on the infrastructure site.
- Document any existing prime habitats. Define any and all efforts to maintain and preserve the prime habitat. Define all restorative or any significant efforts to increase the prime habitat.

Provide all the prime habitats and species defined and outlined within an infrastructure site. Document and maintain a preserve buffer area surrounding the prime habitat and species. Increasing credit for avoidance, then maintenance and then restoring the ecological value of the prime habitat.

1.1.2.4 Potential Credit Application

- Infrastructure site avoids prime habitat entirely.
- Infrastructure site maintains and protects the existing prime habitat throughout infrastructure construction, and life of infrastructure.
- Infrastructure site increases the prime habitat area. The prime habitat area is increased through the development process of the infrastructure project.

1.1.2.5 Other Information and Resources

1. CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Section 4.1.1.
2. Third party organization standards and definitions of prime habitats, such as, the Sustainable Forestry Initiative (SFI), Forest Stewardship Council (FSC), and the Canadian Standards Association (CSA).

1.2 NW 1.2 Protect Wetlands and Surface Water

1.2.1 Collection, Stormwater

1.2.1.1 Objective

Protect, buffer, enhance and restore areas designated as wetlands, shorelines, and water bodies by providing natural buffer zones, vegetation and soil protection zones. Build awareness of cumulative effects on broader ecosystem services and carrying capacity in a watershed context.

1.2.1.2 Relevance

Highly Applicable – HA

Preserves and enhances many of the ecosystem service values that contribute to the health and welfare of our communities while reducing the need for infrastructure that is costly to build and maintain.

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1.2.1.3 Relevant Actions

- Maintain natural land features (including soil and vegetation) throughout the watershed to take advantage of free ecosystem services that provide free water volume and quality controls.
- Provide adequate buffering around surface waters and wetlands that protect water quality and quantity, habitat and ecosystem services and increase resilience to extreme events
- Vary buffer widths depending on water resource sensitivity, topography, and degree of upland development, which affects runoff volume and quality to be treated; more intensive development and land disturbance require added treatment capacity of wider buffer strips.
- Use green practices that mimic natural landscape features, pollution prevention and land preservation to reduce runoff volume and pollutant loads thus reducing dependency on buffers and costly stormwater infrastructure.

1.2.1.4 Potential Credit Application

- Use of natural watershed features, green practices and pollution prevention to protect and enhance water quality and quantity
- Buffer widths adequate to treat upland stormwater runoff volume and quality based on development intensity, topography and land management features
- Percent of surface waters and wetlands adequately buffered to preserve natural water quality and habitat features and ecosystem services that support socio-economic needs.

1.2.1.5 Other Information and Resources

1.3 NW 1.3 Preserve Prime Farmland

1.3.1 Biosolids, Municipal Resource Recovery Facility

1.3.1.1 Objective

Identify and protect soils designated as prime farmland, unique farmland, or farmland of statewide importance

1.3.1.2 Relevance

LA – Limited Applicability

The applicability of this credit is primarily tied to the initial geographic site selection of the wastewater treatment, biosolid treatment, or biosolid land application. It could also be applied to instances where existing facilities are removed, and the land restored to a productive farming condition.

1.3.1.3 Relevant Actions

Consult the United States Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) and Web Soil Survey (WSS) online databases to determine the presence of areas deemed as "prime farmland" in the proposed project area. If present, take action to relocate project site, or minimize impact while protecting Vegetation and Soil Protection Zones (VSPZ).

1.3.1.4 Potential Credit Application

- Consider the presence of prime farmland in the vicinity of the proposed project site, and take steps to relocate, or minimize impact to these designated areas (temporary or permanent impact).
- If decommissioning existing features for no further use, also demolish and remove them from the site, and then restore the soils and site conditions such that it can be used for farming activities.

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- Consider how planning or construction of wastewater collection systems will impact growth in vicinity or on prime farmland, and minimize impacts.
- Identify areas designated as prime farmland by USDA during project planning.

1.3.1.5 Other Information and Resources

1. USDA NRCS Web Soil Survey (WSS): http://websoilsurvey.nrcs.usda.gov/app/
2. 43 FR 4031: http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&rgn=div5&view=text&node=7:6.1.3.6.27&idno=7

1.4 NW1.4 Avoid Adverse Geology

1.4.1 Collection, Stormwater

1.4.1.1 Objective

Avoid development in adverse geologic formations and safeguard aquifers to reduce natural hazards risk and preserve high quality groundwater resources.

1.4.1.2 Relevance

Applicable – A

The avoidance of adverse geologic formations and protection of aquifers and groundwater resources largely relates to proper siting of sewers, pump/lift stations and force mains. This will generally relate to new collection system facilities, but could also be applicable to sewer separation projects designed to reduce combined sewer overflow (CSO) discharges.

1.4.1.3 Relevant Actions

Identify underlying geology, aquifers and groundwater resources in the project area for new collection system facilities or facilities to be relocated so that new/relocated facilities can be sited to avoid such vulnerable resources. If such resources cannot be avoided, ensure sewers and force mains are constructed without connecting points or joints within the underlying resource. If joints are unavoidable, ensure watertight connections that are properly specified and that the construction meets the specification requirements. For pump/lift stations, ensure the wet well and connecting points are watertight. During operation, continue routine, regular leak detection inspections.

For sewer separation projects to reduce CSO discharges, the combined sewer is usually converted to a storm sewer, new sanitary sewers installed and stormwater Best Management Practices (BMPs) installed to control stormwater on-site. When locating and designing these facilities, the impacts on underlying geologic formations, aquifers and groundwater resources should be carefully evaluated and pollution prevention measures included in the project facility design and construction. If any stormwater outfalls are added as part of the project, outfall impacts should be carefully analyzed to avoid adverse impacts.

1.4.1.4 Potential Credit Application

- Avoidance of adverse geology, aquifers and groundwater resources with allowance for buffer areas between wastewater collection facilities and such resources.
- Installation of watertight pipe without joints in areas crossing adverse geologic formations, aquifers and groundwater resources.

1.4.1.5 Other Information and Resources

1. TCEQ, Edwards Aquifer Protection Program, http://www.tceq.texas.gov/field/eapp , Accessed August 3, 2014.

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1.4.2 Biosolids, Municipal Resource Recovery Facility

1.4.2.1 Objective

Avoid development in adverse geologic formations and safeguard aquifers to reduce natural hazards risk and preserve high quality groundwater resources.

1.4.2.2 Relevance

HA – Highly Applicable for Infrastructure

The overall goal for this credit is to identify and mitigate the geological substrate of the anticipated infrastructure design area, thereby reducing water loss and improving groundwater quality.

1.4.2.3 Relevant Actions

- Identify the geology of the infrastructure project site area to prevent and minimize direct and indirect impacts of the natural risks and to increase the groundwater quality.
- Documentation of coordination and collaboration with state or local agencies regarding classifications or regulations regarding geological risks and dangers.
- Document and define the infrastructure site in detail as to the extent and limits of measures to protect the groundwater quality through identification and avoidance of risky geology.
- Provide a geologic map of the infrastructure site.
- Document any risky geology. Define any and all efforts to avoid questionable geology. Define all restorative or any significant efforts to avoid risky geology and improve or maintain groundwater quality.

Provide the underground geology defined and outlined within an infrastructure site. Document the groundwater quality and actions to protect and improve the groundwater quality. Increasing credit for identification, protection, risk management, and avoidance of geological risks within the Infrastructure project site area. Protecting the community from natural risks and providing increased groundwater quality.

1.4.2.4 Potential Credit Application

- Infrastructure site avoids risky geology entirely.
- Infrastructure site identifies the geological natural risks and maintains and protects the Infrastructure throughout construction, and life of infrastructure.
- Infrastructure site improves the groundwater quality and protects the Community from natural geological risks by avoidance of risky geology.

1.4.2.5 Other Information and Resources

1. USGS Groundwater, Karst topography, http://water.usgs.gov/ogw/karst/
2. IAH Commission on Karst Hydrogeology, http://karst.iah.org/
3. USEPA-Groundwater Protection Branch, USGS-Water Resources Division, Karst Identification-Groundwater in Karst Terrain, http://karstwaters.org/files/dyetracer.pdf
4. Third party organization standards and definitions of Geological risks, such as, the National Geological Society, USGS Groundwater Information, International Association of Hydrogeologists (IHG.org), USEPA

1.5 NW 1.5 Preserve Floodplain Functions

1.5.1 Collection, Stormwater

1.5.1.1 Objective

Preserve floodplain functions by limiting development and development impacts to maintain water management capacities and capabilities. Protect human health and welfare by reducing infrastructure vulnerabilities to flooding and storm surge.

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1.5.1.2 Relevance

Applicable – A

Any project with planned construction in the floodplain or floodway will have to complete permit applications that may be sufficient for an enhanced level. Stream restoration projects will have the ability for higher levels of achievement by improving sediment transport, vegetation, and water quality.

However, if the project does not have any construction in the floodplain or floodway, this credit will not be applicable. For collection systems projects, projects involving stream crossings or structures such as pump stations or remote treatment facilities will be most applicable.

1.5.1.3 Relevant Actions

- Document project siting alternatives and selection; limit new impervious areas in floodplain.
- Perform river modeling associated with permit applications to show changes in flood elevations
- Prepare flood emergency management plan
- Document proposed stream restoration activities
- Document planned O&M activity to ensure floodplain functions will not be affected by site maintenance.
- Use integrated watershed management practices that build watershed resiliency and dampen potential effects of runoff and flooding from extreme events while protecting a broad suite of ecosystem services.

1.5.1.4 Potential Credit Application

- Use permit application and supporting information towards Improved achievement
- Use site plan showing reduced impervious area and increased vegetation towards Enhanced achievement
- Use flood emergency management plan towards Superior achievement in conjunction with habitat restoration plans
- Use sediment transport analysis and planned improvements towards conserving achievement.
- Use integrated watershed management to maintain and enhance ecosystem services that mitigate flooding and build watershed resilience and carrying capacity for development that reduce risks

1.5.1.5 Other Information and Resources

1. No Adverse Impact Floodplain Management Community Case Studies (Association of State Floodplain Managers, 2004)
2. Floodplain Restoration and Storm Water Management: Guidance and Case Study (Chagrin River Watershed Partners, Inc., 2009)

1.6 NW 1.6 Avoid Unsuitable Development on Steep Slopes

1.6.1 Collection, Stormwater

1.6.1.1 Objective

Protect steep slopes and hillsides from inappropriate and unsuitable development in order to avoid exposures and risks from erosion and landslides, and other natural hazards.

1.6.1.2 Relevance

Moderately Applicable – MA

For both collection and stormwater, collection systems, infrastructure previously built in hillsides or other locations with steep slopes are periodically rehabilitated or replaced. New infrastructure can be sited to avoid these areas.

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1.6.1.3 Relevant Actions

- Incorporate erosion control into site selection and design. Documentation of erosion control measures should include site plans, details, specifications, and applicable standards.
- Documentation of the site selection process should contain slope information on sites considered, and the selection of a project site or alignment that avoids steep slopes. An overall topographic or contour map may be included.

1.6.1.4 Potential Credit Application

- Document alignment and site selection process to avoid steep slopes – such as using a deep tunneled conduit instead of an open cut conduit installed in the hillside.
- If potential sites for pump station or other facilities involve construction on steep slopes, take reasonable steps to research and fully evaluate alternative locations that would avoid the condition.

1.6.1.5 Other Information and Resources

1. Pennsylvania Steep Slope Ordinance - http://conservationtools.org/guides/show/59-Steep-Slope-Ordinance
2. Mountain Ridge and Steep Slope Protection Advisory Committee (Land-of-Sky Regional Council, 2008)
3. I-69 Planning Toolbox, Hillside/Steep Slope Protection, http://www.in.gov/indot/div/projects/i69planningtoolbox/_pdf/Hillside_Steep%20Slope%20Protection.pdf

1.6.2 Biosolids, Municipal Resource Recovery Facility

1.6.2.1 Objective

Protect steep slopes and hillsides from inappropriate and unsuitable development to avoid exposures and risks from erosion and landslides, and other natural hazards.

1.6.2.2 Relevance

MA – Moderately applicable

In many cases, natural topography and the benefits of gravity flow dictate the location of treatment systems and related facilities. However, often there are two or more options with potentially different slope conditions. Also, it may be possible to avoid an otherwise attractive steep slope at a minimal cost.

1.6.2.3 Relevant Actions

- If potential sites for treatment or related facilities involve construction on steep slopes, take reasonable steps to research and fully evaluate alternative locations that would avoid the condition.
- Design facilities to manage erosion and potential slides.

1.6.2.4 Potential Credit Application

Scoring for wastewater facilities can follow the method presented in the Guidance Manual directly as written.

1.6.2.5 Other Information and Resources

1. I-69 Planning Toolbox, Hillside/Steep Slope Protection, http://www.in.gov/indot/div/projects/i69planningtoolbox/_pdf/Hillside_Steep%20Slope%20Protection.pdf

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1.7 NW 1.7 Preserve Greenfields

1.7.1 Collection, Stormwater

1.7.1.1 Objective

Conserve undeveloped land by locating projects on previously developed greyfield sites and/or sites classified as brownfields.

1.7.1.2 Relevance

Moderately Applicable – MA
Preserving greenfields relates to the proper siting of collection system infrastructure. This will generally relate to construction of new infrastructure such as pump stations, sewers and force mains, but could also be applicable to sewer separation or storage projects design to reduce, divert and/or treat combined sewer overflows (CSO) discharges.

The intent of this credit is to minimize the impact to wildlife, and lessen the pressure of development on greenfields.

This credit does not apply to a street, roadway, or altered landscapes resulting from current agricultural se, forestry use or use as a preserved natural area.

1.7.1.3 Relevant Actions

- Identify greenfields in the vicinity of the proposed infrastructure so that the new infrastructure can avoid such lands. Reuse existing developed sites for siting these new facilities to the extent possible. These include areas that have preexisting paving, construction, altered landscaped or have been previously documented to have been contaminated.

1.7.1.4 Potential Credit Application

- Avoidance of a greenfield for construction of new collection system infrastructure by reusing a previously developed area (greyfield).
- Remediate and reuse of a brownfield for siting of collection system infrastructure. Brownfield as defined by a local, state or federal government agency or documented by means of an ASTM E1903-11 Phase II Environmental Site Assessment. Remediation measures should suffice future use of the site.

1.7.1.5 Other Information and Resources

1. ASTM E1903-11 Standard Practice for Environmental Site Assesments: Phase II Environmental Site Assessment Process

1.7.2 Biosolids, Municipal Resource Recovery Facility

1.7.2.1 Objective

Conserve undeveloped land by locating projects on previously developed greyfield sites and/or sites classified as brownfields.

1.7.2.2 Relevance

MA – Moderately Applicable
The application of this credit will be very project specific, with applicability to only a new wastewater treatment plant. This credit is limited to the availability of greyfield or brownfield sites in the watershed.

1.7.2.3 Relevant Actions

- Identify greyfield or brownfield sites within the watershed that could be used to construct new wastewater treatment plants
- If designated as a brownfield site, assess whether it can easily be cleaned up for use as a site for a new wastewater treatment plant

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- Consider benefits of land application of biosolids on varying land types and designations

1.7.2.4 Potential Credit Application

- Optimize the existing treatment plant capacity by using abandoned tank volumes before using new sites for construction.
- During plant upgrades, select treatment processes that support future retrofits like an IFAS or MBBR- for increased flow rates.

1.7.2.5 Other Information and Resources

1. The Sustainable Site Initiative: Guidelines and Performance Benchmarks, 2009

2 Natural World- Land and Water

2.1 NW 2.1 Manage Stormwater

2.1.1 Collection, Stormwater

2.1.1.1 Objective

Minimize the impact of infrastructure on stormwater runoff quantity and quality.

2.1.1.2 Relevance

HA – Highly Applicable

The purpose of this credit is to reduce the impact of construction on stormwater runoff. In construction of stormwater / collections infrastructure on development or redevelopment projects, there are many opportunities for the incorporation of technologies to enhance stormwater runoff quality and minimize or fully capture runoff quantity.

2.1.1.3 Relevant Actions

- Identify local and regional regulatory requirements for stormwater management during construction and for post construction stormwater runoff quality and quantity management.
- Assess the project for opportunities to employ LID (low impact design) measures (i.e., stormwater BMPs) and reduce storm water quantity to pre-development generation or better to meet or exceed target water storage capacity.
- For a project in design, review the proposed systems for stormwater quality measures (i.e., stormwater BMPs) incorporated into the design to attain improved stormwater runoff quality.
- Ensure that the project will not negatively affect the receiving waters and will not result in safety problems or be detrimental to the ecological function of downstream waters.
- Identify hydraulic capacity issues in existing system during planning and design.

2.1.1.4 Potential Credit Application

- Incorporation of LID measures to restore the water storage/infiltration ability and reduce impervious surface at the project site in lieu of use of traditional grey systems incorporated for stormwater management.
- Target storage capacity should be applied during project planning to determine level of achievement which can be employed with the use of LID measures.
- Incorporation of construction and post-construction stormwater BMPs used to meet or exceed regulatory requirements for stormwater runoff quantity and quality.
- Develop stormwater calculations to determine target percent improvement in site's infiltration/evaporation/water harvest capacity using TR-55 methodology or continuous simulation modeling.
- If construction is in previously undisturbed/undeveloped areas, the post construction site restoration should return the area to pre-construction site conditions.

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- New collection system projects evaluated for existing capacity issues and hydraulic improvements incorporated into design.

2.1.1.5 Other Information and Resources

1. Metropolitan St. Louis Sewer District Site Design Guidance
2. Maryland Stormwater Design Guide
3. EPA Website for SW BMPs http://www.epa.gov/nrmrl/wswrd/wq/stormwater/bmp.html

2.1.2 Biosolids, Municipal Resource Recovery Facility

2.1.2.1 Objective

Minimize the impact of infrastructure on stormwater runoff quantity and quality.

2.1.2.2 Relevance

HA - Highly Applicable

Mandating different levels of low impact development (LID) during the design phases for new constructions, rehabilitations, upgrades and process improvements can minimize the impact of stormwater runoff quantity and quality. Points for this credit are project specific but there are many pathways to achieve all levels of achievement for the management of stormwater for wastewater treatment.

2.1.2.3 Relevant Actions

Relevant actions or steps that the practitioner should take in addressing this credit for a project are as follows:

- Develop a stormwater pollution prevention plan (SWPPP) and a storm water quality management plan (SWQMP).
- Perform TR-55 (technical release 55) calculations for stormwater capacities and detention (storage).
- Document the relevant LID measures or technologies that will be implemented within the design, which effect stormwater quality management prior to, during and post-construction.
- Calculate and document the percentage improvement for greyfield or brownfield sites and if 100% of the target water storage capacity is achieved or exceeded.

2.1.2.4 Potential Credit Application

- Route all drains around biosolids production areas to the plant influent, not to a storm drain.
- Provide drainage infrastructure that will maintain the existing drainage path without causing flooding.
- Provide swale around the perimeter of the facility to maintain positive drainage and to help to mitigate flooding.
- Incorporate low impact development measures by using less impervious surface/cover and more green space to reduce runoff from the facility and/or seepage into it.
- Maintain the stormwater runoff volume for predevelopment during and post construction.
- Incorporate a stormwater quality feature like a hydrodynamic separator to route any spills or process overflows through it before it is discharged into the storm system.
- Incorporate onsite storage capacity or treatment capabilities

2.1.2.5 Other Information and Resources

1. Rational method
2. HEC RAS (USACE Hydraulic Engineering Center River Analysis System)
3. SWMM (EPA Stormwater Management Model)

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2.2 NW 2.2 Reduce Pesticide and Fertilizer Impacts

2.2.1 Collection, Stormwater

2.2.1.1 Objective

Reduce non-point source pollution by reducing the quantity, toxicity, bioavailability and persistence of pesticides and fertilizers, or by eliminating the need for the use of these materials.

2.2.1.2 Relevance

MA – Moderately applicable
The purpose of this credit is to reduce the impact to receiving waters due to application of pesticides and fertilizers.

If vegetative stormwater controls are employed on site for stormwater management or landscaped areas installed for aesthetics, selection of plants used will dictate the need for the use of pesticides or fertilizers.

Also, could have applicability during construction projects where potential negative impacts to receiving waters could occur during site restoration (e.g., seeding of disturbed areas and applying fertilizers).

2.2.1.3 Relevant Actions

Determine what vegetation/plant selection will be incorporated on site and specify type and frequency of the use of pesticides, fertilizers, or herbicides that will be needed.

2.2.1.4 Potential Credit Application

- List of plants species selected for site and type of fertilizer needed or if pesticide will be required.
- Select vegetation requiring minimal to no fertilizer should be considered for use and pesticide planning should incorporate integrated pest management if applicable and cost effective.
- Select pesticides and fertilizers which are low toxicity, persistence, and bioavailability as part of the vegetative maintenance plan.
- Develop site restoration specifications that eliminate the use of pesticides or fertilizers.

2.2.1.5 Other Information and Resources

2.2.2 Biosolids, Municipal Resource Recovery Facility

2.2.2.1 Objective

Reduce non-point source pollution by reducing the quantity, toxicity, bioavailability and persistence of pesticides and fertilizers, or by eliminating the need for the use of these materials.

2.2.2.2 Relevance

HA – Highly Applicable
Water resource recovery facility (WRRF) site plans can incorporate layouts, landscaping, and ground cover that significantly reduce the need for fertilizers and pesticides. In addition, the use of stormwater best management practices (BMPs), and constructed wetlands can significantly reduce the impact of any pesticides or fertilizers that are used. Facility operations can procure and use fertilizers that have reduced potential to contribute to non-point source pollution. Most importantly, the beneficial use of biosolids can have a major positive community or regional impact through minimizing or eliminating the need for commercial fertilizers. These biosolids can include liquid, cake, or dried product such as Milorganite®.

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2.2.2.3 Relevant Actions

As part of the design of WRRFs, especially for new greenfield sites, the site layout and design can include features to control runoff to minimize groundwater and surface water contamination and can incorporate stormwater BMPs. Landscaping can be selected that require minimal or no pesticides, herbicides, and fertilizer. Operations procurement can require fertilizers and pesticides to have minimal potential to impact non-point source pollution.

The land application of biosolids for beneficial reuse has a significant potential to reduce or eliminate the use of fertilizer by providing the nutrients, trace elements, moisture, and soil conditioner required for crop or turf growth while recycling a WRRF product.

2.2.2.4 Potential Credit Application

- Design site incorporating stormwater BMPs.
- Develop Stormwater Pollution Prevention Plan
- Select landscaping that minimizes or eliminates the need for fertilizer and pesticides.
- Document biosolids reuse impact on the rate of fertilizer and/or pesticide application.
- Develop nutrient management plan
- Certification of biosolids program by the National Biosolids Partnership.

2.2.2.5 Other Information and Resources

1. Possible technologies:
    a. Pervious or permeable pavement
    b. Constructed wetlands
    c. Xeriscaping
    d. Bio-retention areas
    e. Infiltration basins
    f. Bio-swales
    g. Sludge stabilization and production of biosolids for beneficial reuse
    h. Sludge drying for production of Class A product
2. Project examples or case studies:
    a. Cedar Hills, Cross Plains, WI - Selbig, W.R., and Bannerman, R.T., 2008, A comparison of runoff quantity and quality from two small basins undergoing implementation of conventional- and low-impact-development (LID) strategies: Cross Plains, Wisconsin, water years 1999–2005: U.S. Geological Survey Scientific Investigations Report 2008–5008, 57 p
    b. Tacoma, Washington Tagro product.
    c. Milwaukee MSD Milorganite product.
    d. NBP, EMS-based Biosolids Management Program Certification, http://www.wef.org/Biosolids/page.aspx?id=7554
3. Design of Municipal Wastewater Treatment Facilities, Manual of Practice No. 8, Chapter 6, Energy Management and Sustainability, 2012????
4. EPA Landscaping and Lawn Care webpage that also contains an extensive list of references. http://water.epa.gov/polwaste/npdes/swbmp/Landscaping-and-Lawn-Care.cfm
5. Stormwater Pollution Prevention Plan – this plan addresses all aspects of stormwater, not just fertilizers and pesticides. http://water.epa.gov/polwaste/npdes/stormwater/Stormwater-Pollution-Prevention-Plans-for-Construction-Activities.cfm
6. International Stormwater BMP Database - http://www.bmpdatabase.org/index.htm
7. Urban Stormwater Best Management Practices Study, August 1999, EPA 821-R-99-012
8. Urban Stormwater BMP Performance Monitoring, April 2002, EPA 821-B-02-001

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9. National Pollutant Removal Performance Database, Center for Watershed Protection, September 2007
10. Phosphorus in Biosolids: How to Protect Water Quality While Advancing Biosolids, Fact Sheet, Water Environment Federation and National Biosolids Partnership, May 2014
11. Chartering the Future of Biosolids Management, Water Environment Federation and National Biosolids Partnership, May 2011
12. Enabling the Future: Advancing Resource Recovery from Biosolids, Water Environment Federation, Water Environment Research Foundation, and National Biosolids Partnership, 2013
13. Land Application and Composting of Biosolids, Fact Sheet, Water Environment Federation, May 2010
14. Control of Pathogens and Vector Attraction in Sewage Sludge, USEPA, Office of Research and Development, EPA/625/R-92/013, December 1992
15. USEPA, Office of Wastewater Management, Emerging Technologies for Biosolids Management, EPA 832-R-06-05, Page 1-1. (2006).

2.3 NW 2.3 Prevent Surface and Groundwater Contamination

2.3.1 Collection, Stormwater

2.3.1.1 Objective

Preserve fresh water resources by incorporating measures to prevent pollutants from co-contaminating surface and groundwater and monitor impacts over operations.

2.3.1.2 Relevance

MA – Moderately applicable
The purpose of this credit is to prevent contamination to groundwater or receiving waters due to project activities.

Stormwater control system may be designed to incorporate post construction stormwater BMPs which prevent pollutants from reaching surface water and provide treatment via infiltration/filtration practices.

Construction projects that may have potential negative impacts to water quality.

2.3.1.3 Relevant Actions

- Identify potential sources and pathways of contamination during the project construction and identify measures for containment in SWPPP.
- Site any post construction stormwater BMPs used for stormwater quantity and/or quality which can be applied for levels of achievement preventing surface water or ground water contamination. Most stormwater projects will not have potential for spill of polluted waters or impact to groundwater contamination after construction.

2.3.1.4 Potential Credit Application

- Develop SWPP for construction phase.
- Reference stormwater calculations and post construction stormwater BMPs on project which prevent surface water contamination and potentially groundwater contamination.
- Perform modeling or hydrologic studies to identify pathways for contamination
- Develop spill response plans, containment requirements and monitoring programs to detect spills or identify other potential sources during the project
- CIPP cure water. If pipe to be lined leads to an outfall, must capture and treat the cure water or specify styrene-free resins.

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2.3.1.5 Other Information and Resources

1. ASTM 1216 - Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube
2. EPA Stormwater Pollution Prevention Plans for Construction Activities (http://www3.epa.gov/npdes/pubs/sw_swppp_guide.pdf)

2.3.2 Biosolids, Municipal Resource Recovery Facility

2.3.2.1 Objective

Preserve fresh water resources by incorporating measures to prevent pollutants from contaminating surface and groundwater and monitor impacts over operations.

2.3.2.2 Relevance

HA – Highly applicable

The primary purpose of municipal wastewater treatment is to reduce oxygen loads on receiving streams by treating Biochemical Oxygen Demand (BOD). Additionally, solids and ammonia, must also typically be reduced prior to discharge. Increasingly other constituents including nitrate-nitrogen, phosphorus, and heavy metals are also regulated in discharge permits. Treated water must be disinfected prior to discharge to reduce pathogens. Attitudes towards direct and indirect potable reuse are evolving and becoming a consideration in arid and semi-arid regions.

2.3.2.3 Relevant Actions

The typical permit application and resulting permit will establish the baselines for acceptable treatment and monitoring requirements. These will include periodic effluent sampling and toxicity testing. Modeling of impacts to the receiving stream may be required by the regulating agency. Influent monitoring, in addition to the standard effluent testing, should be considered to allow documentation of efficiency (percent removal) of monitored constituents.

2.3.2.4 Potential Credit Application

- For effluent discharges affecting aquifer recharge zones, documentation of hydrogeologic delineation studies should be provided, taking into consideration the complexity of the aquifers. Note that delineation may have already been done by local authorities.
- For projects situated in areas where the groundwater is used as a source for drinking water, documentation of compliance with governing authority regulations, permits, etc. should be provided.
- Documentation of long-term surface or groundwater quality monitoring programs should be provided. Stream monitoring data may already be collected by a local governmental agency. Subsurface discharge may require a program for long term monitoring well operation and data collection.
- The discharge permit should provide adequate documentation that the constructed works would not reasonably have any impact on receiving waters. The daily monitoring reports will provide documentation that the discharges to receiving waters are monitored to verify pollutant loading. Periodic toxicity testing will document any biological impact on receiving waters.
- Chemicals used on site should have spill and leak prevention and response plans.
- Plans and drawings for the site should include provisions for handling stormwater.

2.3.2.5 Other Information and Resources

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3 Natural World- Biodiversity

3.1 NW 3.1 Preserve Species Biodiversity

3.1.1 Collection, Stormwater

3.1.1.1 Objective

Protect biodiversity by preserving and restoring species and habitats. Minimize watershed disturbance and preserve natural hydrology, soils and vegetation to the maximum extent practicable.

3.1.1.2 Relevance

Highly Applicable – HA

Protection of biodiversity parallels protection of ecosystem services that fuel our economy and create the social setting and lifestyle that we enjoy and appreciate. High biodiversity indicates a setting with preservation and management features that are as close to natural as possible that provide the physical setting and water quality and quantity that is resilient and productive for natural biota and humans alike.

3.1.1.3 Relevant Actions

These are similar to above actions and fortuitously cross cut multiple social, economic and environmental needs and goals, consistent with ecosystem-based management principles (Especially NW1.1 and NW 1.2):

- Avoid development in prime habitat areas
- Be aware of indirect effects of development on lands that have ecological links to prime habitats, especially barriers to migration corridors and upstream watershed alterations
- Conserve prime habitat lands in project areas and include adequate buffering with consideration to migratory corridors and overall watershed condition and carrying capacity
- Maintain natural land features (including soil and vegetation) throughout the watershed to take advantage of free ecosystem services that provide free water volume and quality controls.
- Provide adequate buffering around surface waters and wetlands that protect water quality and quantity, habitat and ecosystem services and increase resilience to extreme events
- Vary buffer widths depending on water resource sensitivity, topography, and degree of upland development, which affects runoff volume and quality to be treated; more intensive development and land disturbance require added treatment capacity of wider buffer strips.
- Use green practices that mimic natural landscape features, pollution prevention and land preservation to reduce runoff volume and pollutant loads thus reducing dependency on buffers and costly stormwater infrastructure.
- Restore or allow passive recovery of habitats to strengthen and protect prime habitat values
- Recognize that preservation and natural recovery are the best management tools for prime and health habitats. Minimize disturbance footprints and conserve land to the maximum extent possible
- Recognize ecosystem service trade-offs from unavoidable development disturbance to ensure social and economic benefits are optimized and ecosystem impacts minimized

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3.1.1.4 Potential Credit Application

Like the "Relevant Actions" above, the credit application is also the same as for NW 1.1 and 1.2, highlighting the importance of integrated and ecosystem-based management approaches:

- Ratio of prime habitat lands preserved or conserved to lands disturbed and developed
- Indirect effects to prime habitats from adjacent lands are minimized, especially migration corridors, watershed health, and adequate buffers
- Project footprint of land disturbance is minimized and natural land features, soils and vegetation are protected to the maximum extent
- Use of natural watershed features, green practices and pollution prevention to protect and enhance water quality and quantity
- Buffer widths adequate to treat upland stormwater runoff volume and quality based on development intensity, topography and land management features
- Percent of surface waters and wetlands adequately buffered to preserve natural water quality and habitat features and ecosystem services that support socio-economic needs.
- Ecosystem service trade-offs are quantified and balanced in a socio-economic context at the watershed scale
- Opportunities for mitigation, restoration and recovery are taken

3.1.1.5 Other Information and Resources

3.1.2 Biosolids, Municipal Resource Recovery Facility

3.1.2.1 Objective

Protect biodiversity by preserving and restoring species and habitats.

3.1.2.2 Relevance

MA – Moderately applicable

Wastewater treatment inherently provides an improved aquatic habitat. For credits to be applied in this field, the applicant must demonstrate specific efforts to improve the natural habitat. Plantings of native vegetation or construction of wildlife habitats that support wildlife communities are examples. The improvements need not be at the adjacent site, but reviewers should consider the improvements based on relative impact based on the project location.

Many capital projects will deal primarily with retrofitting existing facilities. For those projects that require construction of new facilities, preservation of wildlife habitats may be a concern. The regulating state authority (Department of Natural Resources, Department of the Environment, etc.) may have a permitting process that requires the facility to ascertain that no species will be impacted. All projects to which this applies should submit the certification of no impact. For credit, additional improvements are required.

3.1.2.3 Relevant Actions

Assess whether the applicant has specifically addressed wildlife habitat as part of the project. Improvements may include planting native vegetation, supporting natural habitats through construction of improved, low-impact outfalls, or otherwise.

Bike paths and other improvements that allow human integration in the natural environment should not be considered as detrimental toward supporting species biodiversity.

3.1.2.4 Potential Credit Application

- Construction of wetland polishing facilities.

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- Develop zoning ordinances that control the use of land in specific districts or zones, specifically including the designation of natural areas and buffer zones to protect natural areas.
- Acquisition with the purpose of restoration, preservation, or constructing conservation easements, protective buffer zones, or other natural areas, including streambanks, lakeshores, and other water bodies.
- Planting of natural landscaping that attracts native animals and acts as a protective buffer for natural areas.

3.1.2.5 Other Information and Resources

1. "Protecting Nature in Your Community: A Guidebook for Preserving and Enhancing Biodiversity". Available online at: http://www.chicagowilderness.org/what-we-do/protecting-green-infrastructure/epdd-resources/biodiversity-and-natural-habitats/protecting-nature-in-your-community/executive-summary/

3.2 NW 3.2 Control Invasive Species

3.3 NW 3.3 Preserve Native Soils and Restore Disturbed Soils

3.3.1 Collection, Stormwater

3.3.1.1 Objective

Preserve native soils and restore soils disturbed during construction and previous development to bring back ecological and hydrological functions.

3.3.1.2 Relevance

Highly Applicable – HA

Soils are the foundation for good water quality and a healthy ecosystem. They take millennia to form to their peak performance and functionality (100 – 500 years/inch), and once the profile is disrupted, it is not easily restored to its full potential.

3.3.1.3 Relevant Actions

- Minimize soil disturbance during construction, and preserve/conserve areas with undisturbed soil profiles and stable surfaces
- Do not disturb wetland and buffer soils, and work consistently with natural contours to maintain stability and minimize erosion
- Where soils are disturbed, try to replace and restore the natural profile. Do not harvest topsoil for other uses or move it to other areas
- Keep soils vegetated and minimize impervious covers to the extent practicable.
- Where soils and soil profiles are compromised plant vegetation and cover that will help build soil and provide organic matter to promote recovery and restoration
- Do not contaminate soils with fertilizers and pesticides and try to avoid soil compaction with heavy equipment, including turf areas where riding mowers will compact and form pannes. Instead, use native vegetation and low maintenance ground covers and minimize areas that require mowing.
- To the extent possible, use naturally vegetated areas and healthy soils to infiltrate runoff in place of stormwater collection systems.

3.3.1.4 Potential Credit Application

- Preservation of natural contours, vegetation and soil profiles
- Minimize development footprint to minimize soil disruption
- Minimize impervious cover to promote infiltration
- Use native and appropriate vegetation to promote recovery and stabilize damaged and disturbed soils
- Minimize areas of turf and other non-native landscaping

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- Use natural vegetation and soils for infiltration to reduce need for constructed infiltration infrastructure

3.3.1.5 Other Information and Resources

3.3.2 Biosolids, Municipal Resource Recovery Facility

3.3.2.1 Objective

Restore soils disturbed during construction and previous development to bring back ecological and hydrological functions.

3.3.2.2 Relevance

HA – Highly Applicable

The amount of restoration of disturbed soils depends if the structures or facilities are temporary or permanent. For example, if a project requires installation of new equipment to existing structures or buildings, disturbed areas may only consist of the construction office and laydown areas, which are temporary facilities; therefore, allowing for full restoration of the disturbed area. If the project requires construction of new structures, not all of the disturbed soil can be restored.

3.3.2.3 Relevant Actions

Design and construct site improvements on a new site or a previously developed site that enhances the soil's ability to support healthy plants, biological communities, water storage, and water infiltration.

3.3.2.4 Potential Credit Application

- Design plant improvements to disturb less vegetative areas or utilize already disturbed areas
- Use guidance documents from local (city, county, state) and federal authorities for site grading, stormwater, floodplain and landscaping designs
- Require contractors to restore newly and/or previously disturbed areas

3.3.2.5 Other Information and Resources

1. The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Prerequisite 7.2: Restore soils disturbed during construction, Credit 7.3: Restore soils disturbed by previous development
2. Local (City, County, State) Technical Guidance Documents or Local Ordinances
3. National Floodplain Insurance Program Laws and Regulations
4. American Society of Civil Engineers 24, Flood Resistant Design and Construction

3.4 NW 3.4 Maintain Wetland and Surface Water Functions

3.4.1 Collection, Stormwater

3.4.1.1 Objective

Maintain and restore the ecosystem functions of streams, wetlands, water bodies and their riparian areas. Preserve and restore natural landscape features, including soils and vegetation as the primary means to restore ecosystem functions of surface waters and wetlands.

3.4.1.2 Relevance

Highly Applicable – HA

Best opportunities for protecting surface water and wetland functions occur in the contributing watershed, where ecosystem-based management and integrated watershed management will yield the highest return of aquatic habitats and ecosystem services that support economy, social desires and the environment.

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3.4.1.3 Relevant Actions

- Assess watershed condition and carrying capacity to determine additional development that can occur with socially and environmentally acceptable trade-offs.
- Minimize disruption of natural features including topography, soil profiles, and natural vegetation that support high levels of ecosystem diversity reflected in wetland and aquatic systems.
- Use green practices, including pollution prevention, to mitigate effects of disturbance, especially adequately-sized buffers that can effectively treat the volume and quality of runoff created in developed areas.
- Plan with ecosystem-based management principles and use integrated watershed management techniques to ensure optimal use of the land with acceptable levels of trade-offs for society, economy and the environment.

3.4.1.4 Potential Credit Application

- Extent of natural hydrological, topographical and watershed physical and biological features that can be maintained
- No net change in runoff volume and quality and function of healthy wetland and surface water systems.
- Ecosystem-based management principles are applied to integrated watershed planning and management that consider the full suite of physical, chemical and biological attributes essential to healthy ecosystems as well as ecosystem services that sustain economy and lifestyle
- Carrying capacity and potential for degradation are assessed, and developments are designed and effects mitigated with the minimum trade-offs between aquatic ecosystem health and socio-economic needs

3.4.1.5 Other Information and Resources

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SECTION 5 – CLIMATE AND RISK

1 Climate and Risk - Emissions

1.1 CR 1.1 Reduce Greenhouse Gas Emissions

1.1.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

1.1.1.1 Objective

Conduct a comprehensive life-cycle carbon analysis and use this assessment to reduce the anticipated amount of net greenhouse gas emissions during the life cycle of the project, reducing project contribution to climate change.

1.1.1.2 Relevance

HA – Highly Applicable

Most major wastewater projects should be able to pursue the conserving or carbon neutral level of achievement. In some cases, pursuing the restorative or net carbon negative level would be achievable. Smaller projects should evaluate the applicability of achieving a high level in CR1.1. Possibly reducing the life cycle carbon would be more applicable. Carbon emissions should be calculated prior to any mitigation methods and then revised as the projects addresses carbon emissions.

1.1.1.3 Relevant Actions

Consider all sources of emissions from all stages in the project (including construction, long-term operations, and end-of-life emissions) before determining which emissions are given priority for assessment. In most projects several sources of emissions will be substantial and should be included in the assessment. Sources of emissions include:

- Construction: These emissions occur during construction of the project, but do not continue throughout the life of the project. These include emissions from construction equipment, emissions from landscape disturbance, and emissions from the transportation of people and goods to and from the project site.
- Embodied emissions from building materials: The emissions generated from the extraction, processing, and transportation of the materials used in construction;
- Landscape disturbance: The emissions generated through the loss of carbon storage by trees, vegetation, and soil disturbed by construction.
- Energy usage: The ongoing emissions generated from the use of electricity, gas, or other power source during the operations of the project after it is constructed.
- Transportation: The emissions generated from the transport of people and goods to the site after the project is completed; ongoing emissions generated from changes in land use which might affect travel demand patterns should also be considered.
- Waste: The emissions generated from the transport and treatment of waste after the construction of the project. This includes emissions from ongoing garbage, recycling, and food.

1.1.1.4 Potential Credit Application

Mitigation strategies are divided into the following topics:

1. Materials
2. Landscape Disturbance
3. Energy
4. Waste
5. Transportation

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Links to information on each mitigation strategy are provided under other information and resources

1. Materials
    - Recycled Materials
    - Locally-Sourced Materials
    - Wood Products
    - Low Volatile Organic Compound (VOC) Products
    - Vegetation to Extend the Life of External Structures
    - Cement Substitutes
2. Landscape Disturbance
    - Vegetation and Soil Preservation
    - Vegetation Planting
    - Stormwater Runoff
    - Sustainable Practices—Landscaping and Clearing of Vegetation
3. Energy
    - Construction Equipment Emission Reduction
    - Efficient Design and Performance Processes
    - Onsite Renewable Energy Production
    - Electric Cooling System Efficiency
    - Electric Heating System Efficiency
    - Electric Ventilation System Efficiency
    - Natural Heating and Cooling
    - Appliance Efficiency
    - Ongoing Energy Management Systems
    - Insulation
    - Energy Efficient Electric Lighting
    - Water Conservation
    - Other Energy Efficient Equipment
4. Waste
    - Construction Waste Management
    - Recycling Provision
    - Wastewater and Stormwater Reduction Methods
    - Food Facility Waste Management Practices
    - Solid Waste Treatment: Landfill Methane Capture and Management Practices
    - Solid Waste Treatment: Incineration and Other Thermal Processes
    - Solid Waste Treatment: Composting and Other Biological Processes
    - Wastewater treatment: Low Emissions Treatment Processes
5. Transportation
    - Construction
    - Project Location
    - Project Accessibility – Multiple Modes of Travel
    - Road Accessibility – Multiple Modes of Travel

1.1.1.5 Other Information and Resources

1. Calculation Tools
    a. URBEMIS User's Guide, FAQs, and other support www.urbemis.com/support/FAQv9_2.html
    b. CEQA Tools webpage www.airquality.org/ceqa/index.shtml
    c. Greenhouse Gas Emissions from a Typical Passenger Vehicle www.epa.gov/otaq/climate/420f05004.htm
    d. Modeling and Inventories www.epa.gov/otaq/models.htm
    e. MOBILE6 Vehicle Emissions Modeling Software www.epa.gov/otaq/m6.htm

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f. Motor Vehicle Emission Simulator www.epa.gov/otaq/models/moves/index.htm
g. Build Carbon Neutral Calculator http://buildcarbonneutral.org/
h. Center for Urban Forestry Research Tree Carbon Calculator www.fs.fed.us/ccrc/topics/urban-forests/ctcc/
i. Reforestation/Afforestation Project Carbon Online Estimator http://ecoserver.env.duke.edu/RAPCOEv1/

2. Frameworks
    a. National Institute of Building Sciences www.nibs.org/
    b. Whole Building Design Guide (Life-Cycle Costs Analysis) www.wbdg.org/resources/lcca.php
    c. Green Touchscreen and iBPortal Dashboard www.qualityattributes.com/
    d. Bay Area Local Initiatives Support Corporation's Green Rehabilitation Guide www.bayarealisc.org/bay_area/resources/publications_8392/green_10365/index.shtml
    e. Energy Star website, onsite renewable energy generation www.energystar.gov/index.cfm?c=healthcare.bus_healthcare_onsite_energy
    f. Whole Building Design Guide www.wbdg.org/resources/swheating.php
    g. Map of the solar potential in King County www.ecy.wa.gov/climatechange/maps/solar/solar_king.pdf
    h. Map of the wind potential in King County www.ecy.wa.gov/climatechange/maps/wind/wind_king.pdf
    i. ACEE report: Emerging Hot Water Technologies www.aceee.org/research-report/a112
    j. Toolbase Services website, heat pump options www.toolbase.org/ToolbaseResources/level4TechInv.aspx?ContentDetailID=754&BucketID=6&CategoryID=6
    k. Energy Star Guide to Energy-Efficient Heating and Cooling www.energystar.gov/ia/partners/publications/pubdocs/HeatingCoolingGuide FINAL_9-4-09.pdf Download it from the website here: www.energystar.gov/index.cfm?c=heat_cool.pr_hvac
    l. Industry Whitepaper, Cooling with Outside Air www.kelly.net/pdf/liebert-i.pdf
    m. Toolbase Services website, hyrdronic radiant cooling www.toolbase.org/ToolbaseResources/level4TechInv.aspx?ContentDetailID=779&BucketID=6&CategoryID=6
    n. Energy Star, properly sized air conditioners www.energystar.gov/index.cfm?c=roomac.pr_properly_sized
    o. Energy Star, programmable thermostat www.energystar.gov/index.cfm?c=thermostats.pr_thermostats
    p. Energy Star, sealing air ducts www.energystar.gov/index.cfm?c=home_improvement.hm_improvement_ducts
    q. Toolbase Services website, evaporative cooling systems www.toolbase.org/ToolbaseResources/level4TechInv.aspx?ContentDetailID=750&BucketID=6&CategoryID=6
    r. The US Department of Energy's Energy Efficiency, heat pumps www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12610
    s. Toolbase Services website, small scale recovery systems www.toolbase.org/Technology-Inventory/Plumbing/drainwater-heat-recovery
    t. Energy Star Website www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=EP

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u. US Energy Information Administration excel-based calculator www.eia.doe.gov/neic/experts/heatcalc.xls
v. The US Department of Energy's Energy Efficiency, hydronic heating systems www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12590
w. Toolbase Services website, 'dry' residential system overview www.toolbase.org/Techinventory/TechDetails.aspx?ContentDetailID=4028&BucketID=2&CategoryID=42#benefits
x. Energy Star, boilers www.energystar.gov/index.cfm?c=boilers.pr_boilers
y. Energy Star, furnaces www.energystar.gov/index.cfm?c=furnaces.pr_furnaces
z. American Council for Energy Efficient Economy, boiler and furnace efficiency www.aceee.org/consumerguide/heating.htm
aa. Design Brief: Displacement Ventilation www.energydesignresources.com/media/1723/EDR_DesignBriefs_displacementventilation.pdf
bb. Washington State Ventilation and Indoor Air Quality Code https://fortress.wa.gov/ga/apps/sbcc/File.ashx?cid=226
cc. Energy Star website www.energystar.gov/
dd. Guidelines for Selecting Cool Roofs http://www1.eere.energy.gov/femp/pdfs/coolroofguide.pdf
ee. Energy Star Qualified Products www.energystar.gov/index.cfm?c=products.pr_find_es_products
ff. Special Offers and Rebates Finder www.energystar.gov/index.cfm?fuseaction=rebate.rebate_locator
gg. EPEAT website www.epeat.net/
hh. Seattle Public Utilities www.seattle.gov/util/Services/Water/For_Commercial_Customers/SPU01_003445.asp
ii. Cascade Water Alliance http://cascadewater.org/conservation_rebates.php
jj. Greening Federal Facilities document www.nrel.gov/docs/fy01osti/29267.pdf
kk. EPA's WaterSense www.epa.gov/watersense/
ll. EPA's ENERGY STAR Dishwasher www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=DW
mm. Maximum Performance Website www.map-testing.com/
nn. Federal Energy Management Program http://www1.eere.energy.gov/femp/technologies/eut_com_power_mgmt.html
oo. Energy Star Calculator www.energystar.gov/ia/products/power_mgt/LowCarbonITSavingsCalc.xls
pp. Dell Case Study www.1e.com/download/whitepapers/dell_case%20study_us.pdf
qq. California's Shift & Save Program www.shiftnsave.com/pge/howitworks.php
rr. EPA Green Roof Compendium www.epa.gov/heatisland/resources/pdf/GreenRoofsCompendium.pdf Greening Starter Projects, building orientation www.rockmoab.com/greenstart/orient.html
ss. Whole Building Design Guide www.wbdg.org/resources/electriclighting.php
tt. Responsible Purchasing Network's Guide to LED Exit Signs, Street Lights, and Traffic Signals www.seattle.gov/purchasing/pdf/RPNLEDguide.pdf
uu. Energy Star's Traffic Signals www.energystar.gov/index.cfm?c=traffic.pr_traffic_signals
vv. King County's native plant website www.kingcounty.gov/environment/stewardship/nw-yard-and-garden/native-plant-resources-nw.aspx

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ww. Cascade Water Alliance's Irrigation Efficiency Program for Commercial Incentives and Rebates http://cascadewater.org/rebates_irrigation.php
xx. American Council for an Energy-Efficient Economy's Local Policy Toolkit for Water and Wastewater Treatment http://aceee.org/sector/local-policy/toolkit/water
yy. Water and Wastewater Energy Best Practice Guidebook www.werf.org/AM/Template.cfm?Section=Home&TEMPLATE=/CM/ContentDisplay.cfm&CONTENTID=10245

3. Waste
    a. King County, Construction and Demolition Debris Recycling http://your.kingcounty.gov/solidwaste/greenbuilding/debris-recycling.asp
    b. King County Green Tools http://your.kingcounty.gov/solidwaste/greenbuilding/
    c. King County "What do I do with…?" http://your.kingcounty.gov/solidwaste/wdidw/index.asp
    d. King County, Cost Effectiveness of Jobsite Diversion, worksheet http://your.kingcounty.gov/solidwaste/greenbuilding/documents/economics_worksheet.xls
    e. King County, Cost Effectiveness of Jobsite Diversion http://your.kingcounty.gov/solidwaste/greenbuilding/cost-effectiveness.asp
    f. King County, Design Specifications of Waste Management Plans http://your.kingcounty.gov/solidwaste/greenbuilding/specifications-plans.asp
    g. Recycling Economics Worksheet http://your.kingcounty.gov/solidwaste/greenbuilding/documents/economics_worksheet.xls
    h. King County, Jobsite Waste Prevention Guidelines & Resources http://your.kingcounty.gov/solidwaste/greenbuilding/jobsite-waste.asp
    i. King County, Design for Disassembly http://your.kingcounty.gov/solidwaste/greenbuilding/disassembly.asp
    j. King County, Design for Disassembly Guidance Document http://your.kingcounty.gov/solidwaste/greenbuilding/documents/Design_for_Disassembly-guide.pdf
    k. Greening Federal Facilities document www.nrel.gov/docs/fy01osti/29267.pdf
    l. A Guide to Deconstruction: An overview of deconstruction with a focus on Community Development Opportunities www.hud.gov:80/deconstr.pdf.
    m. 2007 Public Space Recycling Pilot www.nyc.gov/html/nycwasteless/html/resources/reports_psr_2007.shtml
    n. EPA Green Roof Compendium www.epa.gov/heatisland/resources/pdf/GreenRoofsCompendium.pdf
    o. WaterSense labeled toilets www.epa.gov/watersense/pp/het.htm
    p. Maximum Performance Website www.map-testing.com/
    q. EPA, Measuring Greenhouse Gas Emissions from Waste www.epa.gov/climatechange/wycd/waste/measureghg.html

4. Transportation
    a. EPA SmartWay www.epa.gov/smartway/
    b. Puget Sound Clean Air Agency www.pscleanair.org/programs/dieselsolutions/idling.aspx
    c. US Dept of Energy's Alternative Fuels & Advanced Vehicles Data Center www.afdc.energy.gov/afdc/fuels/biodiesel.html
    d. Rideshare Online www.rideshareonline.com/
    e. King County Ridematch http://metro.kingcounty.gov/tops/van-car/application.html
    f. Growing Cooler www.smartgrowthamerica.org/growing-cooler
    g. The Victoria Transportation Policy Institute www.vtpi.org/

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h. Smart Growth America www.smartgrowthamerica.org/
i. LEED NC Sustainable Sites Credit 2 – Development Density and Connectivity www.usgbc.org/ShowFile.aspx?DocumentID=1095
j. Excel-based calculator www.vtpi.org/parking.xls
k. Benefits of limiting parking www.vtpi.org/tdm/tdm72.htm
l. Info on parking pricing www.vtpi.org/tdm/tdm26.htm
m. Cascade Bicycle Club www.cbcef.org/bike-commuting.html

1.2 CR 1.2 Reduce Air Pollutant Emissions

1.2.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

1.2.1.1 Objective

Reduce the emissions of six criteria pollutants; particulate matter (including dust), ground level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, lead and noxious odors.

1.2.1.2 Relevance

HA – highly applicable – many opportunities and pathways to achieve high point levels, especially towards the conservative and restorative levels.
Wastewater utilities have many opportunities to meet the conserving level of achievement in construction and operation of wastewater facilities.

The Clean Air Act Amendments of 1990 recognized that many areas across the United States were in violation of the National Ambient Air Quality Standards (NAAQS).

Benchmarking: States and local agencies have varying emissions regulations. Ensure that project meets emission requirement so of the local area throughout design, construction, and operation.

1.2.1.3 Relevant Actions

- One of the first activities for developing an air quality control strategy for these areas is to prepare an inventory of the emissions of interest.
  - Ozone, for example, is photochemically produced in the atmosphere when certain "precursor pollutants" (VOC and NOx) are mixed together in the presence of sunlight. To develop an effective ozone control strategy, an air pollution control agency must compile information on the important sources (plants, businesses, etc.) that emit these precursor pollutants. This compilation -- the emission inventory -- identifies the source types present in an area, the amount of each pollutant emitted, the types of processes and control devices employed, and other information.
  - Emission inventories can serve many purposes. They are used in ambient dispersion modeling and analysis, control strategy development, and in screening sources for compliance investigations. Together with ambient monitoring data, inventory emission estimates have been used as a direct indicator of annual changes in air quality.
  - OAQPS maintains an inventory called the National EPA Emission Trends (NET) database, composed of ozone period, county-level estimates of point, area, and mobile source emissions. Used with modeling programs, NET data helps EPA to verify the attainment/nonattainment status of areas, analyze regulatory policy, and assess the potential impact of any changes in the NAAQS.
  - OAQPS also provides various air pollution models and estimation tools which can be used in emission inventory development.

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- In the project planning and design phase ensure that the project follows and achieves California Ambient Air Quality Standards. Begin developing O&M plans to ensure that the standards are met throughout construction and operation.
- Consider conducting a streamlined Life Cycle Analysis (LCA) to assess material extraction and process staging during construction.
- Cooperate with adjacent communities and residents that may be impacted by emissions from the construction/project site. By engaging the community and their considerations, this can be a factor for other credits.
- Investigate possibly technology and/or monitoring systems that measure and reduce emissions and air quality.
- Similar to CR 1.1, consider the emissions from all stages in the project including:
    - Construction
    - Embodied emissions from building materials
    - Landscape disturbance
    - Energy usage
    - Transportation
    - Waste

1.2.1.4 Potential Credit Application

- Documenting initial air pollutant counts throughout design, construction, and operation phases.
- Documentation of applicable rules and strategies project has taken to be under NAAQS, CAAQS, and SCAQM requirements.
- Documentation of the projects expected "emissions inventory"
- Manufacturing data for products used that monitor or improve air quality.

1.2.1.5 Other Information and Resources

1. Water9, which estimates air emissions of individual waste constituents in wastewater collection, storage, treatment, and disposal facilities as well as a database listing many of the organic compounds; and procedures for obtaining reports of constituent fates, including air emissions and treatment effectiveness http://www.epa.gov/ttn/chief/index.html

2 Climate and Risk- Resilience

2.1 CR 2.1 Assess Climate Threat

2.1.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

2.1.1.1 Objective

Develop a comprehensive Climate Impacts Assessment and Adaptation Plan.

2.1.1.2 Relevance

HA – highly applicable – One level of achievement for producing a plan

Climate change is already affecting the environment in far-reaching ways. Certain types of extreme weather events with links to climate change have become more frequent and/or intense, including prolonged periods of heat, heavy downpours, and, in some regions, floods and droughts. In addition, warming is causing sea level to rise and glaciers and Arctic sea ice to melt, and oceans are becoming more acidic as they absorb carbon dioxide. These and other aspects of climate change are disrupting communities and damaging some sectors of our economy.

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Summers are longer and hotter, and extended periods of unusual heat last longer than any living American has ever experienced. Winters are generally shorter and warmer. Rain comes in heavier downpours. People are seeing changes in the length and severity of seasonal allergies, the plant varieties that thrive in their gardens, and the kinds of birds they see in any particular month in their neighborhoods.

Other changes are even more dramatic. Residents of some coastal cities see their streets flood more regularly during storms and high tides. Inland cities near large rivers also experience more flooding, especially in the Midwest and Northeast. Insurance rates are rising in some vulnerable locations, and insurance is no longer available in others. Hotter and drier weather and earlier snow melt mean that wildfires in the West start earlier in the spring, last later into the fall, and burn more acreage. In Arctic Alaska, the summer sea ice that once protected the coasts has receded, and autumn storms now cause more erosion, threatening many communities with relocation.

Scientists who study climate change confirm that these observations are consistent with significant changes in Earth's climatic trends. Long-term, independent records from weather stations, satellites, ocean buoys, tide gauges, and many other data sources all confirm that our nation, like the rest of the world, is warming. Precipitation patterns are changing, sea level is rising, the oceans are becoming more acidic, and the frequency and intensity of some extreme weather events are increasing. Many lines of independent evidence demonstrate that the rapid warming of the past half-century is due primarily to human activities.

The observed warming and other climatic changes are triggering wide-ranging impacts in every region of our country and throughout our economy. Some of these changes can be beneficial over the short run, such as a longer growing season in some regions and a longer shipping season on the Great Lakes. But many more are detrimental, largely because our society and its infrastructure were designed for the climate that we have had, not the rapidly changing climate we now have and can expect in the future. In addition, climate change does not occur in isolation. Rather, it is superimposed on other stresses, which combine to create new challenges.

2.1.1.3 Relevant Actions

- Evaluate the climate risk of the project area by utilizing things such as previous storm history and NOAA flood maps. Assess different sorts of climate threat impacts such as sea level rise, extreme weather events, or gradual increases in temperature or decreases in precipitation.
- Engage members of the community and local government to ask about their concerns about climate risks around the project area.
- Once potential impacts are identified, consider how those impacts will affect stages of the project including construction and operation.
- Consider with Owners and other project team members, if the project site is expected to be running during a climate risk event.
- Consider utilizing both short and long term plans to mitigate climate threat risks (i.e. in a flood prevention plan, utilizing both higher site walls and temporary flood walls or sandbags).
- Conduct a Life Cycle Analysis (LCA) to determine the net carbon emissions of the project site.

2.1.1.4 Potential Credit Application

- Since this is a yes/no credit, the main criteria/documentation required is a comprehensive climate threat plan, which includes a:
    - Vulnerability Assessment

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    - Risk Assessment
    - Adaptation Assessment
- By documenting additional community engagement throughout the climate threat plan process, it could be applied to additional credits.

2.1.1.5 Other Information and Resources

1. Envision Guidance Manual
2. National Oceanic and Atmospheric Administration (NOAA) http://www.noaa.gov/index.html

2.2 CR 2.2 Avoid Traps and Vulnerabilities

2.2.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

2.2.1.1 Objective

Avoid traps and vulnerabilities that could create high, long-term costs and risks for the affected communities.

2.2.1.2 Relevance

HA - Highly Applicable – High number of points achievable through the initial planning and community engagement.

For many projects within the wastewater industry, the idea of risk assessment for long term vulnerabilities is something that is thoroughly thought out in the design/planning phases. By taking into account the threats identified in CR 2.1 and engaging with the surrounding community, the project team needs to implement elements into the design of the project to prevent some of those risks and threats.

While there are some unavoidable traps that may be out of the project teams control (i.e. a configuration trap in which the project is located in an wetland or low lying coastal area), there are other very achievable traps that can be prevented by the project team (i.e. standard trap for stormwater in which the design team also takes into consideration the stormwater of the surrounding community during an extreme wet-weather event, not that just of the project site). The idea of preventing traps is to not cause long –term and additional disruptions to both the project site/team and the surrounding community.

By investigating the risk and avoiding long-term traps with the project team, stakeholders, and community. Work done to evaluate and create a plan for this credit can easily be applied other credits related risk mitigation and community involvement.

2.2.1.3 Relevant Actions

- During the planning phase of the project, the project team identifies the possible resource constraints and vulnerabilities to both the project site and surrounding community. Identifying both long-term concerns and resource, configuration, and standard traps.
- Project team works with the surrounding community and local officials to identify and evaluate possible threats, traps, and resource allocations.
- Identify key design components that may be affected through climate risks and traps and affect the overall design life of the project.
- Discuss with project team, community, and stakeholders about how the project contribute to the community through resource allocation, demands, and traps and vulnerabilities.

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- Identify the long-term resource allocation and traps that come with the project beyond the design life. And how those traps and resources may affect the surround community and environment.
- Consider alternatives throughout the planning and design phase to better decrease the long-term resource allocation vulnerabilities and traps for both the project and the surrounding community.

2.2.1.4 *Potential Credit Application*

- Incorporating long-term risk mitigation plans into the Operation and Maintenance (O&M) manuals for the project.
- Documentation of the discussions and planning review with community officials and local regulators regarding project and community vulnerabilities and traps.
- Documentation of potential vulnerabilities and traps with associated costs and risks. This can easily be incorporated within an O&M manual or during the planning/design phase.

2.2.1.5 *Other Information and Resources*

1. Envision Guidance Manual

2.3 CR 2.3 Prepare for Long-Term Adaptability

2.3.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

2.3.1.1 *Objective*

Prepare infrastructure systems to be resilient to the consequences of long-term climate change, preform adequately under altered climate conditions, or adapt to other long-term change scenarios.

2.3.1.2 *Relevance*

A - Applicable

Long term adaptability of a wastewater treatment facility depends on its ability to handle drought conditions, wet weather flows and future growth in the watershed. The main challenges faced by the treatment plants are:

- With draught conditions, water conservation practices are encouraged resulting in concentrated wastewater to the treatment facilities.
- Handling peak flows during a wet weather event could be a challenge to the treatment facility. Investing in deep tunnel storage system for storm water can result in lower secondary bypasses at the facilities and improve the receiving water stream.

Therefore, while estimating the plant design flow, understanding population shifts over the next 20, 50 and 100 year in the watershed is essential. It can be helpful to design a project around an envelope of flows, which is plus or minus certain percent of the most likely design flows.

2.3.1.3 *Relevant Actions*

- Minimize flooding at the facility by designing additional facilities to handle a 100 year flood
- Locate blowers and generators above ground to ensure operation during flooding conditions.
- Design facilities to provide reuse quality effluent to handle drought conditions
- Instead of sending all the plant effluent water to the receiving stream diverting a part of it to an affected wetland to restore it
- Facility landscaping using trees and shrubs to reduce the drought condition potential

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2.3.1.4 Potential Credit Application

- Understand and document the stormwater hydrographs for the watershed
- Consider providing additional above ground generators to handle unforeseen energy shortages
- Understand and document the future flows and loads projections with and without the anticipated growth. This will provide a range of flows and loads to design around. This step ensures that the plant stays resilient even when it does not see anticipated growth.
- Evaluate the ecology of effluent receiving stream to identify the potential ways to divert the effluent to a nearby wetland, in order to restore it.

2.3.1.5 Other Information and Resources

1. Envision Guidance Manual

2.4 CR 2.4 Prepare For Short-Term Hazards

2.4.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

2.4.1.1 Objective

Increase resilience and long-term recovery prospects of the project and site from natural and man-made short-term hazards.

2.4.1.2 Relevance

A - Applicable

Short term hazards- both natural and manmade- may have a direct impact on the operation of a wastewater treatment facility. Natural hazards like wildfires, hurricanes and earthquake are unpredictable so providing adequate infrastructure flexibility is a better approach to handle these events. For instance providing backup power supply, using fire-resistant or non-combustible construction material and following a seismic design can increase resilience towards these hazards. Having an emergency evacuation plan is useful to handle the natural hazards.

Preparing for manmade hazards like spills, terrorist activities and epidemics is increasing essential in the urban setup. Increasing water security by fortifying distribution systems or installing decentralized systems could be key options.

2.4.1.3 Relevant Actions

- Identifying the possible hazards around the area and developing an emergency plan
- Providing emergency generators at the facility, as a backup power supply
- Make soil more pervious by planting trees to lessen the effects of flooding
- Invest in green infrastructure to control the amount of runoff during flooding conditions

2.4.1.4 Potential Credit Application

- Conduct surveys to identify the various possible natural and manmade hazards in the watershed.
- Identify the severity of these events- 1 in 50 years, 1 in 100 years etc.
- Provide backup power supply like an emergency generator and develop an emergency evacuation plan of the facility, if required
- Provide plans and designs for incorporating 1 in 50 years or 1 in 100 years hazard event.
- Rehabilitate affected areas of the watershed to lessen the impacts of future hazards

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2.4.1.5 Other Information and Resources

1. WERF Research on Security & Emergency Response of wastewater treatment plants
2. Envision Guidance Manual

2.5 CR 2.5 Manage Heat Island Effects

2.5.1 Collection, Municipal Resource Recovery Facility, Biosolids and Stormwater

2.5.1.1 Objective

Minimize surfaces with a high solar reflectance index (SRI) to reduce localized heat accumulation and manage microclimate.

2.5.1.2 Relevance

HA- Highly applicable

For many wastewater treatment facilities managing heat island effects is twofold- firstly, manage the solar reflectance of a surface and secondly, manage the thermal emittance. Solar reflectance of a material is the ability of the material to reflect the incident solar energy while the thermal emittance is the ability of the material to emit the heat that is already absorbed. Pavements, sidewalks, parking lots and rooftops of the various facility buildings can also absorb incidents solar radiation and can increase the temperature of the surroundings by a few degrees.

In addition to causing discomfort to the personnel working around a wastewater facility, the increased heat can also increase the energy costs associated with cooling the buildings. The higher energy requirement can indirectly result in impaired air quality due to higher SO2, NO2, CO and mercury produced at the power plant.

Heat islands within a treatment facility also result in impaired stormwater quality. When rain water comes in contact with the warmer buildings, the heat from the concrete is transferred to the water, which increases the temperature of the rain water by a few degrees. This increases the temperature of the receiving streams or lakes as the stormwater runoff is eventually discharged to these water bodies, affecting metabolism and reproduction of aquatic life.

2.5.1.3 Relevant Actions

- Planting trees and shrubs- In addition to providing shade, the transpiration from the leaves of trees and shrubs provide moisture that helps cool the surrounding air
- Putting in Green or vegetative roofs- Creating a rooftop garden cools the building by evapotranspiration. The roofs of such buildings can have extensive garden (with one to five inches soil thickness) or intensive garden (with greater than six inches of soil thickness).
- Installing Cool roofs- Cool Roof Rating Council (CRRC) developed a database of material that when used on the roofs of some buildings, can reduce the inside temperature by several degrees.
- Higher SRI construction material- Certain kind of gravel and Portland cement has higher SRI than others. Using such construction material, where possible, can reduce the localized heating affects.

2.5.1.4 Potential Credit Application

- Pavements, sidewalks and parking lots- A WWTP has several pavements and sidewalks that can be reconstructed using the high SRI material or recoated using these materials.

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- Administrative building- Covering the rooftop of the administrative building at a WWTP can reduce the internal temperature to comfortable levels and reduce energy costs
- Mechanical building- Planting trees around the facility, especially around the mechanical buildings can reduce the blower inlet air temperature naturally, without having to spend energy on ventilation fans.

2.5.1.5 Other Information and Resources

1. Cool Roof Rating Council (http://coolroofs.org/),
2. EPA (http://www2.epa.gov/heat-islands)

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