Minne Lusa Basin – Technology Screening TM

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Purpose

The purpose of this Technical Memorandum (TM) is to document the consideration of a full range of Combined Sewer Overflow (CSO) control technologies and to identify those technologies that are viable for each CSO location considering criteria related to engineering, performance, site constraints, water quality goals, flow, and pollutant removal capabilities. The goal of this task is to screen out, on a CSO-by-CSO basis, control technologies that do not control pollutants of concern or have other, clear "fatal flaws" with respect to the screening criteria. The identified viable technologies will be subsequently developed into CSO control alternatives for the Minne Lusa Basin.

Methodology

The "Fact Sheets" included in Appendix A of *Protocol 4 – Alternatives Development and Evaluation* written by the Program Management Team (PMT), dated 08-16-2006, provide a detailed description of technologies that could be utilized for control of Combined Sewer Overflow discharges to the receiving streams. While the list of technologies included in the "Fact Sheets" is extensive, other technologies will be added for consideration if deemed appropriate by the Basin Consultant. The technologies were screened using a fatal flaw analysis at each CSO location. Using engineering judgment each technology was evaluated based on the following CSO system characteristics: water quality information (including water quality standards, water quality data, and pollutants of concern); the CSO magnitude and peak flow rate resulting from a 2-year, 24-hour sample storm; CSO system characterization information (including GIS data, mapping, reports, CIP information, and O&M information); and a Technologies Screening Matrix (Attachment A) listing the CSO control technologies and screening criteria. The CSO magnitude and peak flow rate from the sample storm were used to gage potential technologies and to put these technologies into perspective. The magnitude of the storm event (2-year, 24-hour) was selected by the Program Management Team to represent an event similar to the eventual design storm, which was not available at the time of the screening analysis. The fatal flaw analysis was completed by the Minne Lusa Basin Team without the direct involvement of Stakeholders.

Stakeholders will be directly involved in the development and evaluation of CSO control alternatives.

Technologies Evaluated

The "Fact Sheets" included in Appendix A of Protocol No. 4 (Ibid.) are the primary source of these technologies. Technologies are listed by category: Sewer System Modifications, Flow Reduction, Storage, and Satellite Wet Weather Treatment. The technologies included in this screening process include the following:

Sewer System Modifications

Flow Redirection – the balancing of flows among the pipes of the combined sewer system. One pipe may be surcharged and another pipe may be underutilized during a storm event. A new pipe or diversion could be constructed to redirect flow from the surcharged pipe to the underutilized pipe.

CSO Relocation – the closure of a CSO in a sensitive area and transference of the CSO discharge to a different, less sensitive location.

Pump Station Modifications – significant capital expenditures to upgrade and modify an existing pump station to reliably handle substantially higher flow rates.

Static Flow Control – maximizes flow to the treatment plant using fixed control devices to develop in-line storage, such as fixed weirs, orifices, and vortex controllers.

Variable Flow Control – devices can be opened or closed to make use of in-line storage and dewatering, such as sluice gates, bascule gates, and inflatable dams.

Real Time Flow Control – allows all variable system components, including pump stations, gates, inflatable dams, etc., to be operated from a central location during a storm event to minimize overflow.

Flow Reduction

Stormwater Management – includes many techniques for preventing stormwater from entering the combined sewer system, including upland storage (detention/retention ponds, filter strips, grass swales), rooftop runoff management, and porous pavement.

Inflow Reduction – includes disconnection of storm flow sources from the system, such as roof leaders and area drains, and the removal of streams from being diverted into the combined system.

Infiltration Reduction – involves sewer rehabilitation activities to repair or seal cracks / gaps in the pipes, joints, or manholes where groundwater or some other source of water is allowed to enter into the sewer system.

Sewer Separation – is the construction of new sanitary or storm sewers within a combined sewer service area to separate the flows. The existing sewers serve as either sanitary or storm sewers.

Flow Slipping – utilizes small grates, vortex valves, or other flow control devices to redirect runoff to alternative locations, principally through gutter flow. Diverted flow travels overland or in streets instead of within the combined sewers.

Storage

Open Basins – will hold combined sewage for an extended period of time. They are generally lined to prevent groundwater contamination and may be equipped with aeration and washdown facilities.

Closed Storage Tanks – are generally concrete structures constructed below grade and provide a completely enclosed unit for the storage of captured CSO. Such tanks generally are equipped with maintenance access, aeration facilities, washdown attributes and ventilation and odor control. A pump station may be required to empty the tank.

Vertical Storage – similar to closed storage tanks except vertical storage is constructed by a drilling method as opposed to open cut construction. A pump station is generally required.

Storage Conduits – similar to traditional dry-weather interceptors, except that they tend to be larger. The function of these conduits is to provide the required CSO storage, consolidate several (or all) combined sewer outfalls, and provide conveyance capacity.

Storage Tunnels – are large diameter conveyance pipelines constructed with tunneling technology rather than open cut technology. They are typically much deeper than traditional pipelines, avoiding conflicts with near surface utilities.

Existing Tunnels or Conduits (abandoned) – can be retrofitted to provide storage. Pumping stations may be required to dewater the storage conduits after a wet weather event.

Satellite Wet Weather Treatment

Satellite Wet Weather Treatment – includes a variety of treatment trains depending on the pollutant removal required. They are termed 'satellite wet weather treatment' because they exist at sites remote from the main, full-time wastewater treatment plant and operate only during overflow conditions precipitated by wet weather. The treatment trains are a progression of the single purpose technologies and include:

- Gross Solids Removal
- Gross Solids Removal + Disinfection
- Gross Solids Removal + Settleable Solids Removal
- Gross Solids Removal + Settleable Solids Removal + Disinfection
- Gross Solids Removal + Settleable Solids Removal + Dissolved Solids Removal
- Gross Solids Removal + Settleable Solids Removal + Dissolved Solids Removal + Disinfection

Technology Screening Process

Criteria and Scoring

Screening Criteria used in the initial screening process are summarized in Table 1. Comments will be included in the screening tables and the attached matrices to provide insight into the selection of the designated scores when further clarification is necessary.

Table 1 - Screening Criteria and Scoring Descriptions

Screening Criteria	Description
Reduces CSO volume significantly	Can the use of this technology significantly reduce the untreated volume or frequency of overflows at this CSO location? 0 = Little or no reduction anticipated for small storms as well as large storms 1 = Significant reduction for small storms anticipated; little reduction for large storms 2 = Significant reduction achievable for both small and large storms
Controls pollutants of concern	Can the use of this technology control the discharge of pollutant loads for the pollutants that are of concern at this CSO location? 0 = Little or no reduction in pollutants anticipated for small storms as well as large storms 1 = Reduction for small storms anticipated; little reduction for large storms. 2 = Reduction achievable for both small and large storms Note: Pollutants of concern are *E. coli*, floatable solids, and settleable solids for the Minne Lusa Basin (Program Management Team, from the October 13, 2006 CSO Technology Brainstorming Workshop (*Water Quality.ppt*)).
Site suitability	Are there sites (land) available within this CSO basin that are suitable for the application of this technology? 0 = No sites available 1 = Some sites available but may have limitations on technology application 2 = Ample sites available; site selection not anticipated to be a significant issue

Table 1 - Screening Criteria and Scoring Descriptions	
Screening Criteria	**Description**
Constructability	How difficult is it to construct the technology within this CSO basin (e.g., consider soils, construction laydown area, traffic, noise, odors, safety, length of construction time)? 0 = Major construction impacts to community; most impacts cannot be mitigated 1 = Some construction impacts to community; most impacts can be mitigated 2 = No or minor construction impacts to community; all impacts can be easily mitigated Note: Specific constructability issues include existing utility conflicts, existing and planned developments, and operation of existing collection system facilities.
O&M Feasibility	What is the level of effort necessary to operate and maintain the technology? How consistent is the O&M of this technology with current staff practices? 0 = New technology; limited or no known wet weather applications to date in other cities; complex O&M requiring significant staff resources and training; potential high risks associated with limited O&M 1 = Limited or known wet weather applications; complex O&M requiring additional staff resources and training 2 = Common wet weather application; routine O&M
Permittability	How complex is the permitting of this technology at a location within the basin? 0 = Multiple permits required; high probability that permit(s) will not be granted in a timely manner or mitigation efforts will be too costly in time or money 1 = Multiple permits required; approval process may take significant time or money but is not anticipated to cause significant project implementation delays. 2 = Limited permits required; approval process anticipated to be relatively quick, affordable with very limited impact on project implementation schedule.
Environmental, cultural or historical issues	Are there operating, siting (other than land availability), or construction issues that would affect the environmental, cultural, or historic aspects of the basin that preclude the application of this technology? 0 = Major impacts to land/environment; most impacts cannot be mitigated 1 = Some impacts to land/environment; most impacts can be mitigated 2 = No or minor impacts to land/environment; all impacts can be easily mitigated

Table 1 - Screening Criteria and Scoring Descriptions	
Screening Criteria	**Description**
Neighborhood impacts	Will the technology adversely impact the neighborhood either during construction (e.g., limit access to businesses) or operation (e.g., result in lower property values)? 0 = Major impacts to neighborhood; most impacts cannot be mitigated 1 = Some impacts to neighborhood; most impacts can be mitigated 2 = No or minor impacts to neighborhood; all impacts can be easily mitigated
Life Cycle Cost	Does the technology have a reasonable life cycle cost for this CSO location? 0 = High cost to effectiveness ratio known 1 = Moderate or unknown at this time cost to effectiveness ratio 2 = Low cost to effectiveness ratio anticipated

Minne Lusa CSOs

Each of the technologies was evaluated for the four CSOs in the Minne Lusa Basin: CSO 104 – Mormon Street, CSO 105 – Minne Lusa, CSO 106 – North Interceptor, and CSO 107 – Grace Street. The majority of the sub-basin tributary to the Grace Street outfall is in the Burt Izard basin. Technologies related to source reduction (sewer system modifications and flow reduction) have been screened and evaluated by the Burt Izard Team. Technologies applicable at the outfall (storage and treatment) have been evaluated herein.

Some technologies may be viable for one CSO location, but not another location. Flow and water quality characteristics for each CSO are listed in Table 2.

Table 2 – Flow and Water Quality Characteristics				
CSO Number	**104**	**105**	**106**	**107** [3]
CSO Location	**Mormon Street**	**Minne Lusa**	**North Interceptor**	**Grace Street**
CSO Magnitudes (MG) [1]	1.4	45.6	56.8	19.8
Peak CSO Flows (MGD) [1]	79.3	880	205	343
TSS (mg/L) [2]	n/a	412	278	687
COD (mg/L) [2]	n/a	410	222	247
BOD (mg/L) [2]	n/a	163	54	89
NH_3 - N (mg/L) [2]	n/a	5.2	4.1	3.4
Cadmium, TR (mg/L) [2]	n/a	0	0	0.0013
Chromium, TR (mg/L) [2]	n/a	0.008	0	0.015

Table 2 – Flow and Water Quality Characteristics				
CSO Number	**104**	**105**	**106**	**107 [3]**
CSO Location	**Mormon Street**	**Minne Lusa**	**North Interceptor**	**Grace Street**
Copper, TR (mg/L) [2]	n/a	0.037	0.021	0.050
Lead, TR (mg/L) [2]	n/a	0.043	0.024	0.056
Nickel, TR (mg/L) [2]	n/a	0.007	0.000	0.013
Zinc, TR (mg/L) [2]	n/a	0.28	0.12	0.20
Selenium, TR (mg/L) [2]	n/a	0	0	0
Fecal Coliforms (#/100 mL) [2]	n/a	1,256,458	380,112	403,486
Total Kjeldahl Nitrogen (mg/L) [2]	n/a	16	11	11
Hexane Extractable Material (mg/L) [2]	n/a	31	10	15

Notes:

[1] CSO Magnitudes and CSO Peak Flowrates are based on a 2-Year, 24-Hour Sample Storm. Source: Program Management Team (PMT), from the Basin Study Scoping Session on July 13, 2006 (*Scoping Session 071306_rev2_City.ppt*). The CSO magnitude and peak flow rate from the sample storm were used to gage potential technologies and to put these technologies into perspective. The magnitude of the storm event (2-year, 24-hour) was selected by the Program Management Team to represent an event similar to the eventual design storm, which was not available at the time of the screening analysis.

[2] Program Management Team (PMT), from the October 13, 2006 CSO Technology Brainstorming Workshop (*Water Quality.ppt*).

[3] The majority of the sub-basin tributary to the Grace Street outfall is in the Burt Izard basin. Technologies related to source reduction (sewer system modifications and flow reduction) have been screened and evaluated by the Burt Izard Team.

Minne Lusa Basin team members Michael Ports, B&V; Matt Schultze, B&V; Clay Haynes, B&V; Jim Fitzpatrick, B&V; Kyle Tonjes, HGM; and Cary Duchene, B&V met on Wednesday, November 15, 2006 to perform the preliminary screening of technologies for each CSO outfall. This preliminary screening was further refined and is summarized below in Tables 3, 4, 5 and 6.

Table 3 – CSO 104 - Mormon Street Technology Screening Summary	
Technology	**Screening Process Remarks**
Sewer Separation and CSO Relocation	As described in the *Minne Lusa Baseline Improvements TM* (written by the Minne Lusa Basin Team, dated 11-10-2006), the City has previously separated portions of this sub-basin and has two construction projects underway which will largely complete this separation. In addition, one of the current projects will add a new stormwater detention basin and stormwater outfall sewer. Another project identified in the Minne Lusa Baseline Improvements TM (Ibid.) would increase the size of the interceptor sewer and effectively consolidate the remainder of the CSO into CSO 105 – Minne Lusa. Based on the current and previous CSO control work in this sub-basin, the remaining technologies will not be further considered.

Table 4 – CSO 105 – Minne Lusa Technology Screening Summary	
Technology	**Screening Process Remarks**
Flow Redirection	Some flow redirection already occurs in this sub-basin. In particular, the Minne Lusa Relief Sewer accepts overflows from the Paxton Blvd. trunk sewer at 33rd and Paxton and from the Creighton Blvd. trunk sewer at 31st and Sprague. Additional networking in the sub-basin is feasible.
CSO Relocation	It is feasible to relocate and/or consolidate this CSO. While it is feasible to entirely relocate the outfall, it would likely prove to be cost prohibitive with little additional benefit. It is anticipated that only a portion of the CSO would be relocated (that portion needed to meet the level-of-control and/or number of overflows required). Under this scenario, overflows would continue to discharge at this location when the capacity of the relocation/consolidation conveyance has been reached. The envisioned application would be to provide treatment at one location in the basin, for example at the Grace Street Ditch, rather than at each CSO. If relocation occurred to the Grace Street Ditch, there would be technical issues which would need to be evaluated and addressed, such as hydraulic capacity of the existing outfall from the Grace Street Ditch to the Missouri River. However, these issues could be overcome, for example with additional conveyance to the Missouri River. In and of itself, CSO Relocation would provide little or no reduction in CSO overflow volume (one of the criteria used to screen potential CSO technologies). Based on this criteria, CSO Relocation should technically be fatally flawed. But paired with other technologies it could be a viable technology. CSO 105 discharges to the Missouri River upstream of the intake for the drinking water plant for Council Bluffs, Iowa. Relocation may provide some benefit relative to the sensitive areas evaluation.
Pump Station Modifications	There are no CSO pump stations in the sub-basin which could be modified. The only nearby significant pump station in the basin is the Storz pump station, which is not located near this outfall. The Storz pump station is a stormwater pump station. This is a fatal flaw for this technology for this CSO.

Table 4 – CSO 105 – Minne Lusa Technology Screening Summary	
Technology	**Screening Process Remarks**
Static Flow Control	Static flow control can be employed to increase in-line storage, but typically not without increasing the risk of water-in-basement and street flooding. For example, raising the existing weir at CSO 105 would provide additional in-line storage, would increase the capture of wet-weather flows, and would reduce the number of overflows from the outfall. This is so because some of the very small storm events would now be captured (some amount more than is presently being captured). This could also be accomplished by constructing a series of fixed dams upstream in the system, effectively storing small “wedges” of water. Under lower-flow conditions, these approaches are acceptable and have more minor hydraulic consequences. However, under larger-flow events the hydraulic losses in the sewer system are much more critical. Raising the weir at CSO 105 would, under a larger-flow condition, raise the hydraulic grade line upstream in the sewer by an amount similar to the increase in weir height. An exception in this example would be to provide a significant amount of additional weir length, in which case it might be more cost effective to provide a variable control device. There are numerous records of water-in-basement and street flooding problems upstream of this CSO. The increased hydraulic grade line will not improve but will likely make worse the water-in-basement and street flooding issues in the basin. Therefore, this technology is fatally flawed at this location.
Variable Flow Control	Portions of the sub-basin are relatively hilly with steeper grades on the sewers. However, there are sewers that are relatively flat that may be conducive to variable flow control. However, surcharging of the system may impact service connections and should be evaluated on a case-by-case basis. This technology is viable.
Real-Time Control	Portions of the sub-basin are relatively hilly with steeper grades on the sewers. However, there are sewers that are relatively flat that may be conducive to real-time flow control. However, surcharging of the system may impact service connections and should be evaluated on a case-by-case basis. This technology is viable.
Stormwater Management	There are many different technologies which fall into this category, one or more of which will be suitable towards meeting the goals of the program. Some upland detention is already in place, with additional detention presently under construction. In addition to traditional detention/retention, bio-retention, inlet reconstruction, and other "green" solutions are viable technologies for flow reduction in this sub-basin. Another significant potential for flow reduction is detention/retention in the Forest Lawn Area. This is a viable technology in this sub-basin.
Inflow Reduction	Stormwater in the Forest Lawn area is collected into a stream which drains directly into the Sharron Branch of the Minne Lusa Sewer. This is a potential location for Inflow Reduction. In addition, there are many separated stormwater sewers in this sub-basin which discharge back into the combined sewers. These inflow sources could be scalped from the combined system with a stormwater collector tunnel. Disconnection of roof leaders and area drains are also a viable option within the basin. However, the extent to which roof leaders and area drains are connected to the combined sewer system in the basin is unknown at this time. Information is not available to evaluate or quantify the magnitude that roof leader disconnections would have on the system. This is a viable technology in this sub-basin.
Infiltration Reduction	Information provided by the Program Management Team indicates that infiltration does not appear to be significant based on dry weather flows in the basin. Therefore the benefit of infiltration reduction on the magnitude of the CSOs is small which has been reflected in the Technology Screening matrix scoring for this basin. Infiltration reduction is a viable technology in this sub-basin.
Sewer Separation	Selected portions of this sub-basin have already been separated. Additional separation is a feasible technology toward meeting program goals.

Table 4 – CSO 105 – Minne Lusa Technology Screening Summary	
Technology	**Screening Process Remarks**
Flow Slipping	Flow slipping is a viable option for this basin where catch basins could be removed and flows allowed to continue down the hill to the next street where a storm system could be constructed. Removal of catch basins could affect neighborhood flooding and would need to be carefully evaluated for each area. This technology is viable.
Open Basins	The proximity of possible sites for open basins relative to developed areas results in a fatal flaw. Furthermore, capturing and treating odors from large open basins would be difficult, also resulting in a fatal flaw.
Closed Storage Tanks	Closed storage tanks (near surface-level, relatively shallow) are feasible. This would likely require additional land purchase. Prime possibilities include Power Park (approximately 16 acres) north of and adjacent to the outfall, and the trailer court (approximately 20 acres) south of and adjacent to the outfall. Linear storage under and along the outfall channel (approximately 9 acres) is also an option. The design storm overflow volume is approximately 140 acre-feet (45.6 MG). Some concerns related to this type of storage include the ability to convey the collected event to treatment (Burt-Izard PS, South Interceptor condition and capacity, or new conveyance) and available treatment at the MO River WWTP (or added capacity). Would also require a pump station to dewater the storage tank(s).
Vertical Storage	Vertical storage is feasible and would offer a storage option requiring less land than the closed storage option. The same land options exist as described above. A 100 foot diameter shaft, 200 feet deep represents 11.75 MG. It was estimated that four shafts would require a site between 6 and 11 acres.
Storage Conduits	Storage conduits are feasible, but would require the purchase of land or easement rights along a linear route. This technology is viable.
Storage Tunnels	Storage tunnels are viable. A preliminary review of available geological data indicates a suitable rock formation for tunneling. To put the conduit into perspective, a sample tunnel 20,000 linear feet long (the approximate distance from CSO 105 to the Grace Street Ditch), 20 foot in diameter provides 47 MG of storage. The storage provided by this sample tunnel would be adequate to store the overflow volume noted in Table 2.
Existing Tunnels or Conduits (abandoned)	There are no known abandoned tunnels or conduits in this area. This is a fatal flaw for this technology.
Gross Solids Removal	Without a disinfection process the proposed treatment bundle does not address the need to control the E. coli pollutant of concern. This is a fatal flaw for this technology as a stand alone technology, but it may well provide a partial solution to a larger plan for CSO control.
Gross Solids Removal + Disinfection	While this treatment combination can not be ruled as a fatal flaw, it should be noted that it may be judged inadequate in addressing the settleable solids pollutant of concern. Therefore, additional monitoring, evaluation, etc. should be expected to demonstrate the adequacy of this technology.
Gross Solids Removal + Settleable Solids Removal	Without a disinfection process the proposed treatment bundle does not address the need to control the E. coli pollutant of concern. This is a fatal flaw for this technology as a stand alone technology, but it may well provide a partial solution to a larger plan for CSO control.

Table 4 – CSO 105 – Minne Lusa Technology Screening Summary	
Technology	**Screening Process Remarks**
Gross Solids Removal + Settleable Solids Removal + Disinfection	The technology is certainly available and is feasible. Siting a facility is also feasible, but would require purchasing land. Prime possibilities include Power Park (approximately 16 acres) north of and adjacent to the outfall and the trailer court (approximately 20 acres) south of and adjacent to the outfall. The outfall channel represents an available linear area (approximately 9 acres). However, siting a treatment plant on such a narrow site would present some additional challenges making it less desirable that the other possibilities.
Gross Solids Removal + Settleable Solids Removal + Dissolved Solids Removal	Without a disinfection process the proposed treatment bundle does not address the need to control the E. coli pollutant of concern. Furthermore, it is unlikely that the incremental costs of dissolved solids removal will be justified by the benefits since dissolved solids have not been identified as pollutants of concern.
Gross Solids Removal + Settleable Solids Removal + Dissolved Solids Removal + Disinfection	The technology is feasible, but it is unlikely that the incremental costs of dissolved solids removal will be justified by the benefits since dissolved solids have not been identified as pollutants of concern.

Table 5 – CSO 106 – North Interceptor Technology Screening Summary	
Technology	**Screening Process Remarks**
Flow Redirection	Some flow redirection already occurs in this sub-basin. In particular, the Minne Lusa Relief Sewer accepts overflows from the Paxton Blvd. trunk sewer at 33rd and Paxton and from the Creighton Blvd. trunk sewer at 31st and Sprague. Additional networking in the sub-basin is feasible.
CSO Relocation	It is feasible to relocate and/or consolidate this CSO. While it is feasible to entirely relocate the outfall, it would likely prove to be cost prohibitive with little additional benefit. It is anticipated that only a portion of the CSO would be relocated (that portion needed to meet the level-of-control and/or number of overflows required). Under this scenario, overflows would continue to discharge at this location when the capacity of the relocation/consolidation conveyance has been reached. The envisioned application would be to provide treatment at one location in the basin, for example at the Minne Lusa Outfall, rather than at each CSO. If relocation occurred to the Minne Lusa Outfall, there would be technical issues which would need to be evaluated and addressed, such as hydraulic capacity of the existing channel to the Missouri River. However, these issues could be overcome, for example with additional conveyance to the Missouri River. In and of itself, CSO Relocation would provide little or no reduction in CSO overflow volume (one of the criteria used to screen potential CSO technologies). Based on this criteria, CSO Relocation should technically be fatally flawed. But paired with other technologies it could be a viable technology.
Pump Station Modifications	There are no CSO pump stations in the sub-basin which could be modified. This is a fatal flaw for this technology for this CSO.

Table 5 – CSO 106 – North Interceptor Technology Screening Summary	
Technology	**Screening Process Remarks**
Static Flow Control	Static flow control can be employed to increase in-line storage, but typically not without increasing the risk of water-in-basement and street flooding. For example, raising the existing weir at CSO 106 would provide additional in-line storage, would increase the capture of wet-weather flows, and would reduce the number of overflows from the outfall. This is so because some of the very small storm events would now be captured (some amount more than is presently being captured). This could also be accomplished by constructing a series of fixed dams upstream in the system, effectively storing small "wedges" of water. Under lower-flow conditions, these approaches are acceptable and have more minor hydraulic consequences. However, under larger-flow events the hydraulic losses in the sewer system are much more critical. Raising the weir at CSO 106 would, under a larger-flow condition, raise the hydraulic grade line upstream in the sewer by an amount similar to the increase in weir height. An exception in this example would be to provide a significant amount of additional weir length, in which case it might be more cost effective to provide a variable control device. There are numerous records of water-in-basement and street flooding problems upstream of this CSO. The increased hydraulic grade line will not improve but will likely make worse the water-in-basement and street flooding issues in the basin. Therefore, this technology is fatally flawed at this location.
Variable Flow Control	Portions of the sub-basin are relatively hilly with steeper grades on the sewers. However, there are sewers that are relatively flat that may be conducive to variable flow control. However, surcharging of the system may impact service connections and should be evaluated on a case-by-case basis. This technology is viable.
Real-Time Control	Portions of the sub-basin are relatively hilly with steeper grades on the sewers. However, there are sewers that are relatively flat that may be conducive to real-time flow control. However, surcharging of the system may impact service connections and should be evaluated on a case-by-case basis. This technology is viable.
Stormwater Management	There are many different technologies which fall into this category, one or more of which will be suitable towards meeting the goals of the program. Some upland detention is already in place. In addition to traditional detention/retention, bio-retention, inlet reconstruction, and other "green" solutions are viable technologies for flow reduction in this sub-basin.
Inflow Reduction	There are many separated stormwater sewers in this sub-basin which discharge back into the combined sewers. These inflow sources could be scalped from the combined system through a stormwater collector tunnel. Disconnection of roof leaders and area drains are also a viable option within the basin. However, the extent to which roof leaders and area drains are connected to the combined sewer system in the basin is unknown at this time. Information is not available to evaluate or quantify the magnitude that roof leader disconnections would have on the system. This is a viable technology in this sub-basin.
Infiltration Reduction	Information provided by the Program Management Team indicates that infiltration does not appear to be significant based on dry weather flows in the basin. Therefore the benefit of infiltration reduction on the magnitude of the CSOs is small which has been reflected in the Technology Screening matrix scoring for this basin. Infiltration reduction is a viable technology in this sub-basin.
Sewer Separation	Selected portions of this sub-basin have already been separated. Additional separation is a feasible technology toward meeting program goals.

Table 5 – CSO 106 – North Interceptor Technology Screening Summary	
Technology	**Screening Process Remarks**
Flow Slipping	Flow slipping is a viable option for this basin where catch basins could be removed and flows allowed to continue down the hill to the next street where a storm system could be constructed. Removal of catch basins could affect neighborhood flooding and would need to be carefully evaluated for each area. This technology is viable.
Open Basins	The proximity of possible sites for open basins relative to developed areas results in a fatal flaw. Furthermore, capturing and treating odors from large open basins would be difficult, also resulting in a fatal flaw.
Closed Storage Tanks	Closed storage tanks (near surface-level, relatively shallow) are feasible. The Grace Street Ditch area could be used and represents approximately 10 acres. Additional land purchase would likely be required. Prime possibilities near the outfall include the concrete ready-mix plant property adjacent to the west (approximately 6 acres), adjacent to the south but north of Abbott Drive are two open parcels (approximately 6 and 11 acres), and another open area north of Grace street between the railroad tracks and the access road to the tank farm (approximately 11 acres). South of Grace Street and west of the Union Pacific Railroad is an area designated for redevelopment which has been assumed to be unavailable. Another possibility would be to provide closed storage tanks (near surface-level, relatively shallow) in the Boyd Park area to relieve the Minne Lusa Relief Sewer where it joins with the North Interceptor. Since CSO 106 and 107 are adjacent to each other, the Minne Lusa basin team chose to address them together. The combined sample storm overflow volume from CSO 106 and 107 is approximately 235 acre-feet (76.6 MG). Some concerns related to this type of storage include the ability to convey the collected event to treatment (Burt-Izard PS, South Interceptor condition and capacity, or new conveyance) and available treatment at the MO River WWTP (or added capacity). Would also require a pump station to dewater the storage tank(s).
Vertical Storage	Vertical storage is feasible and would offer a storage option requiring less land than the closed storage option. The same land options exist as described above. A 100 foot diameter shaft, 200 feet deep represents 11.75 MG. It was estimated that seven shafts would require a site between 10 and 20 acres.
Storage Conduits	Storage conduits are feasible, but would require the purchase of land or easement rights along a linear route. This technology is viable.
Storage Tunnels	Storage tunnels are viable. A preliminary review of available geological data indicates a suitable rock formation for tunneling. To put the conduit into perspective, a sample tunnel 20,000 linear feet long (the approximate distance from CSO 105 to the Grace Street Ditch), 26 foot in diameter provides 79 MG of storage. The storage provided by this sample tunnel would be adequate to store the overflow volume from both CSO 106 and CSO 107 noted in Table 2.
Existing Tunnels or Conduits (abandoned)	There are no known abandoned tunnels or conduits in this area. This is a fatal flaw for this technology.

Table 5 – CSO 106 – North Interceptor Technology Screening Summary

Technology	Screening Process Remarks
Gross Solids Removal	Without a disinfection process the proposed treatment bundle does not address the need to control the E. coli pollutant of concern. This is a fatal flaw for this technology as a stand alone technology, but it may well provide a partial solution to a larger plan for CSO control. There is an existing screening facility at the downstream end of the Grace Street Ditch. The primary source of flow in the Grace Street Ditch is from CSO 106 and CSO 107. The facility screens flows (gross solids removal) from the Grace Street Ditch prior to passing to the outfall pipe which discharges to the Missouri River.
Gross Solids Removal + Disinfection	While this treatment combination can not be ruled as a fatal flaw, it should be noted that it may be judged inadequate in addressing the settleable solids pollutant of concern. Therefore, additional monitoring, evaluation, etc. should be expected to demonstrate the adequacy of this technology.
Gross Solids Removal + Settleable Solids Removal	Without a disinfection process the proposed treatment bundle does not address the need to control the E. coli pollutant of concern. This is a fatal flaw for this technology as a stand alone technology, but it may well provide a partial solution to a larger plan for CSO control.
Gross Solids Removal + Settleable Solids Removal + Disinfection	The technology is certainly available and is feasible. Siting a facility is also feasible, but would require purchasing land. The 10 acre Grace Street Ditch area would be available, but it is a narrow parcel and would possibly require the purchase of an adjacent parcel. Prime possibilities include the concrete ready-mix plant adjacent to the west (approximately 6 acres), adjacent to the south but north of Abbott Drive are two open parcels (approximately 6 and 11 acres), and another open area north of Grace street between the railroad tracks and the access road to the tank farm (approximately 11 acres). South of Grace Street and west of the Union Pacific Railroad is an area designated for redevelopment which has been assumed to be unavailable.
Gross Solids Removal + Settleable Solids Removal + Dissolved Solids Removal	Without a disinfection process the proposed treatment bundle does not address the need to control the E. coli pollutant of concern. Furthermore, it is unlikely that the incremental costs of dissolved solids removal will be justified by the benefits since dissolved solids have not been identified as pollutants of concern.
Gross Solids Removal + Settleable Solids Removal + Dissolved Solids Removal + Disinfection	The technology is feasible, but it is unlikely that the incremental costs of dissolved solids removal will be justified by the benefits since dissolved solids have not been identified as pollutants of concern.

Table 6 – CSO 107 – Grace Street Technology Screening Summary

Technology	Screening Process Remarks
Flow Redirection	The sewer system modifications options are being evaluated by the Burt Izard Basin Team for this CSO.
CSO Relocation	The sewer system modifications options are being evaluated by the Burt Izard Basin Team for this CSO.
Pump Station Modifications	The sewer system modifications options are being evaluated by the Burt Izard Basin Team for this CSO.

Table 6 – CSO 107 – Grace Street Technology Screening Summary	
Technology	**Screening Process Remarks**
Static Flow Control	The sewer system modifications options are being evaluated by the Burt Izard Basin Team for this CSO.
Variable Flow Control	The sewer system modifications options are being evaluated by the Burt Izard Basin Team for this CSO.
Real-Time Control	The sewer system modifications options are being evaluated by the Burt Izard Basin Team for this CSO.
Stormwater Management	The flow reduction options are being evaluated by the Burt Izard Basin Team for this CSO.
Inflow Reduction	The flow reduction options are being evaluated by the Burt Izard Basin Team for this CSO.
Infiltration Reduction	The flow reduction options are being evaluated by the Burt Izard Basin Team for this CSO.
Sewer Separation	The flow reduction options are being evaluated by the Burt Izard Basin Team for this CSO.
Flow Slipping	The flow reduction options are being evaluated by the Burt Izard Basin Team for this CSO.
Open Basins	The proximity of possible sites for open basins relative to developed areas results in a fatal flaw. Furthermore, capturing and treating odors from large open basins would be difficult, also resulting in a fatal flaw.
Closed Storage Tanks	Closed storage tanks (near surface-level, relatively shallow) are feasible. The Grace Street Ditch area could be used and represents approximately 10 acres. Additional land purchase would likely be required. Prime possibilities near the outfall include the concrete ready-mix plant property adjacent to the west (approximately 6 acres), adjacent to the south but north of Abbott Drive are two open parcels (approximately 6 and 11 acres), and another open area north of Grace street between the railroad tracks and the access road to the tank farm (approximately 11 acres). South of Grace Street and west of the Union Pacific Railroad is an area designated for redevelopment which has been assumed to be unavailable. Since CSO 106 and 107 are adjacent to each other, the Minne Lusa basin team chose to address them together. The combined sample storm overflow volume from CSO 106 and 107 is approximately 235 acre-feet (76.6 MG). Some concerns related to this type of storage include the ability to convey the collected event to treatment (Burt-Izard PS, South Interceptor condition and capacity, or new conveyance) and available treatment at the MO River WWTP (or added capacity). Would also require a pump station to dewater the storage tank(s).
Vertical Storage	Vertical storage is feasible and would offer a storage option requiring less land than the closed storage option. The same land options exist as described above. A 100 foot diameter shaft, 200 feet deep represents 11.75 MG. It was estimated that seven shafts would require a site between 10 and 20 acres.
Storage Conduits	Storage conduits are feasible, but would require the purchase of land or easement rights along a linear route. This technology is viable.

Table 6 – CSO 107 – Grace Street Technology Screening Summary	
Technology	**Screening Process Remarks**
Storage Tunnels	Storage tunnels are viable. A preliminary review of available geological data indicates a suitable rock formation for tunneling. To put the conduit into perspective, a sample tunnel 20,000 linear feet long (the approximate distance from CSO 105 to the Grace Street Ditch), 26 foot in diameter provides 79 MG of storage. The storage provided by this sample tunnel would be adequate to store the overflow volume from both CSO 106 and CSO 107 noted in Table 2.
Existing Tunnels or Conduits (abandoned)	There are no known abandoned tunnels or conduits in this area. This is a fatal flaw for this technology.
Gross Solids Removal	Without a disinfection process the proposed treatment bundle does not address the need to control the E. coli pollutant of concern. This is a fatal flaw for this technology as a stand alone technology, but it may well provide a partial solution to a larger plan for CSO control. There is an existing screening facility at the downstream end of the Grace Street Ditch. The primary source of flow in the Grace Street Ditch is from CSO 106 and CSO 107. The facility screens flows (gross solids removal) from the Grace Street Ditch prior to passing to the outfall pipe which discharges to the Missouri River.
Gross Solids Removal + Disinfection	While this treatment combination can not be ruled as a fatal flaw, it should be noted that it may be judged inadequate in addressing the settleable solids pollutant of concern. Therefore, additional monitoring, evaluation, etc. should be expected to demonstrate the adequacy of this technology.
Gross Solids Removal + Settleable Solids Removal	Without a disinfection process the proposed treatment bundle does not address the need to control the E. coli pollutant of concern. This is a fatal flaw for this technology as a stand alone technology, but it may well provide a partial solution to a larger plan for CSO control.
Gross Solids Removal + Settleable Solids Removal + Disinfection	The technology is certainly available and is feasible. Siting a facility is also feasible, but would require purchasing land. The 10 acre Grace Street Ditch area would be available, but it is a narrow parcel and would possibly require the purchase of an adjacent parcel. Prime possibilities include the concrete ready-mix plant adjacent to the west (approximately 6 acres), adjacent to the south but north of Abbott Drive are two open parcels (approximately 6 and 11 acres), and another open area north of Grace street between the railroad tracks and the access road to the tank farm (approximately 11 acres). South of Grace Street and west of the Union Pacific Railroad is an area designated for redevelopment which has been assumed to be unavailable.
Gross Solids Removal + Settleable Solids Removal + Dissolved Solids Removal	Without a disinfection process the proposed treatment bundle does not address the need to control the E. coli pollutant of concern. Furthermore, it is unlikely that the incremental costs of dissolved solids removal will be justified by the benefits since dissolved solids have not been identified as pollutants of concern.
Gross Solids Removal + Settleable Solids Removal + Dissolved Solids Removal + Disinfection	The technology is feasible, but it is unlikely that the incremental costs of dissolved solids removal will be justified by the benefits since dissolved solids have not been identified as pollutants of concern.

The completed Technologies Screening Matrix for each Minne Lusa Basin CSO is included in Appendix A.

Viable Technologies

Listed in Table 7 are the technologies which appear viable at the four Minne Lusa Basin CSOs based on the Technologies Screening Matrix. The scores in the matrix will be used to provide a gross ranking of the technologies as basin-wide alternatives are formulated.

Table 7 – Viable Technologies Summary

Technology	CSO 104 Mormon Street	CSO 105 Minne Lusa	CSO 106 North Interceptor	CS 107 Grace Street
Flow Redirection	Fatal Flaw	Viable	Viable	These technologies are being evaluated by the Burt Izard Basin Team for this CSO. Refer to the Burt Izard Technology Screening TM.
CSO Relocation	Viable	Viable	Viable	
Pump Station Modifications	Fatal Flaw	Fatal Flaw	Fatal Flaw	
Static Flow Control	Fatal Flaw	Fatal Flaw	Fatal Flaw	
Variable Flow Control	Fatal Flaw	Viable	Viable	
Real-Time Control	Fatal Flaw	Viable	Viable	
Stormwater Management	Fatal Flaw	Viable	Viable	
Inflow Reduction	Fatal Flaw	Viable	Viable	
Infiltration Reduction	Fatal Flaw	Viable	Viable	
Sewer Separation	Viable	Viable	Viable	
Flow Slipping	Fatal Flaw	Viable	Viable	
Open Basins	Fatal Flaw	Fatal Flaw	Fatal Flaw	Fatal Flaw
Closed Storage Tanks	Fatal Flaw	Viable	Viable	Viable
Vertical Storage	Fatal Flaw	Viable	Viable	Viable
Storage Conduits	Fatal Flaw	Viable	Viable	Viable
Storage Tunnels	Fatal Flaw	Viable	Viable	Viable
Existing Tunnels or Conduits	Fatal Flaw	Fatal Flaw	Fatal Flaw	Fatal Flaw
Gross Solids Removal Alone	Fatal Flaw	Fatal Flaw	Fatal Flaw [1]	Fatal Flaw [1]
Gross Solids Removal + Disinfection	Fatal Flaw	Viable	Viable	Viable
Gross Solids Removal + Settleable Solids Removal	Fatal Flaw	Fatal Flaw	Fatal Flaw	Fatal Flaw
Gross Solids Removal + Settleable Solids Removal + Disinfection	Fatal Flaw	Viable	Viable	Viable
Gross Solids Removal + Settleable Solids Removal + Dissolved Solids Removal	Fatal Flaw	Fatal Flaw	Fatal Flaw	Fatal Flaw

Table 7 – Viable Technologies Summary				
Technology	**CSO 104** **Mormon Street**	**CSO 105** **Minne Lusa**	**CSO 106** **North Interceptor**	**CS 107** **Grace Street**
Gross Solids Removal + Settleable Solids Removal + Dissolved Solids Removal + Disinfection	Fatal Flaw	Viable	Viable	Viable
Notes: [1] There is an existing screening facility at the downstream end of the Grace Street Ditch. The primary source of flow in the Grace Street Ditch is from CSO 106 and CSO 107. The facility screens flows (gross solids removal) from the Grace Street Ditch prior to passing to the outfall pipe which discharges to the Missouri River.				

Short Term Projects

In accordance with Protocol 4, any improvements identified during this task which would provide significant water quality or system improvement benefits and can be implemented at a relatively low capital cost should be identified as "short term projects." The technology screening for the four Minne Lusa CSOs did not identify any specific short-term projects, except those which were already identified in the Minne Lusa Baseline Improvements TM (written by the Minne Lusa Basin Team, dated 11-10-2006). Alternatives for sewer separation (including flow slipping and flow redirection) and control of the combined sewer overflows are currently being developed and refined with further detail to identify potential short term projects for these outfalls.

Schematics of Other Control Alternatives

The technology screening process did not identify other control alternatives; therefore, schematics of the other control alternatives were not created as part of this technical memorandum.

Potential Technologies for Potential Multi-Basin Evaluation

During the screening process, technologies with potential applicability to control CSOs in multiple basins were identified and listed in Table 7.

Table 7 – Multi-Basin Technology Evaluation Summary	
Technology	**Description**
Storage and Conveyance Tunnels / CSO Relocation	Storage tunnel options are viable for the overflows from the Minne Lusa basin. Since tunnels are a linear improvement, they could be routed to receive flow from multiple basins – providing both storage and ultimate conveyance to the Missouri River WWTP or a satellite treatment plant. Dry weather flows from Minne Lusa would continue to be sent into the Burt Izard basin.
Satellite Treatment	As discussed above, both the Grace Street Ditch site and the Minne Lusa site are potential locations for a satellite treatment facility. The Grace Street site is obviously more closely located to other basins and likely represents a better value as a cross-basin solution. Overflows from other basins could be imported through a conveyance tunnel or a storage tunnel, which would provide some storage to mitigate peak flows to the plant.
Real-Time Control	Real-time control used in conjunction with other CSO control technologies would be best implemented across multiple basins to take full advantage of available capacity (storage, treatment, conveyance, etc.). For example, real-time control could be implemented in conjunction with a storage tunnel alternative or an alternative employing a conveyance tunnel paired with satellite treatment. The tunnel would be connected to multiple CSOs. Flow into the tunnel at each CSO connection would be governed by a gate controlled through a real-time control system – a supervisory, control and data acquisition (SCADA) system. The system would maximize in-line storage in the combined sewer system to reduce overflows and reduce overall overflow volume. The in-line stored volume could also be relieved in anticipation of an ensuing precipitation event as monitored on a Doppler Radar system.

Acronym/Term	Definition
City	City of Omaha
CIP	Capital Improvement Plan
CSO	Combined Sewer Overflow
CSS	Combined Sewer System
DWF	Dry-Weather Flow
GIS	Geographic Information System
LTCP	Long Term Control Plan
MG	Million Gallons
MGD	Million Gallons per Day
mg/L	Milligrams per liter
mL	Milliliters
MRWWTP	Missouri River Wastewater Treatment Plant
O&M	Operation and Maintenance
PMT	Program Management Team
TM	Technical Memorandum
U.S. EPA	United States Environmental Protection Agency
WIB	Water in Basement
WWF	Wet-Weather Flow

Attachment 1 – Technologies Screening Matrixes

Technologies Screening Matrix

CSO Number: 104
CSO Location: Mormon Street

Scoring:
2 = Applicable at This Location
1 = Limited applicability
0 = "Fatal Flaw" - Not viable technology (1)

Technology	Screening Criteria: Reduces CSO volume significantly	Controls pollutants of concern	Site suitability	Constructibility	O&M feasibility	Permittability	Environmental, cultural or historical issues	Neighborhood impacts	Life Cycle Cost	Other (Specify)	Total Score	Comment/Rationale
Sewer System Modifications												
Flow Redirection										0	0	See Remarks under *CSO Relocation* and *Sewer Seperation*. The CSO Control Technology for this CSO has been determined by construction projects currently underway.
CSO Relocation	2	2	2	2	2	2	2	2	2	2	20	The City has existing construction projects underway which will provide some seperation and CSO Relocation (Consolidation) which will eliminate the overflow at CSO 104.
Pump Station Modifications										0	0	
Static Flow Control										0	0	
Variable Flow Control										0	0	
Real-Time Control										0	0	
Other (Add technology)										0	0	
Flow Reduction												
Stormwater Management										0	0	
Inflow Reduction										0	0	
Infiltration Reduction										0	0	
Sewer Separation - Full or Partial within Specified Geography	2	2	2	2	2	2	2	2	2	2	20	The City has existing construction projects underway which will provide some seperation and CSO Relocation (Consolidation) which will eliminate the overflow at CSO 104.
Flow Slipping										0	0	
Other (Add technology)										0	0	
Storage												
Open Basins										0	0	
Closed Storage Tanks										0	0	
Vertical Storage										0	0	
Storage Conduits										0	0	
Storage Tunnels										0	0	
Existing Tunnels or Conduits (abandoned)										0	0	
Other (Add technology)										0	0	
Satellite Treatment (2)												
Gross Solids Removal										0	0	
Gross Solids Removal + Disinfection										0	0	
Gross Solids Removal + Settleable Solids Removal										0	0	
Gross Solids Removal + Settleable Solids Removal + Disinfection										0	0	
Gross Solids Removal + Settleable Solids Removal + Dissolved Solids Removal										0	0	
Gross Solids Removal + Settleable Solids Removal + Dissolved Solids Removal + Disinfection										0	0	
Other (Add technology)										0	0	

Notes:
1. A "0" score indicates "fatal flaw", technology not viable at given location; Explain rationale specifically with comment.
2. Satellite wet weather treatment includes a variety of treatment trains depending on the pollutant removal required. The treatment trains are a progression of the purpose of individual technologies. Individual technologies per treatment category are provided in the Fact Sheets.

Technologies Screening Matrix

CSO Number: 105
CSO Location: Minne Lusa

Scoring:
2 = Applicable at This Location
1 = Limited applicability
0 = "Fatal Flaw" - Not viable technology (1)

Technology	Screening Criteria: Reduces CSO volume significantly	Controls pollutants of concern	Site suitability	Constructibility	O&M feasibility	Permittability	Environmental, cultural or historical issues	Neighborhood impacts	Life Cycle Cost	Other (Specify)	Total Score	Comment/Rationale
Sewer System Modifications												
Flow Redirection	1	1	2	2	2	2	2	1	2		15	Some Flow Redirection already occurs into the Minne Lusa Relief Sewer at Sprague Street. Additional "networking" in the system is feasible.
CSO Relocation	1	1	2	2	2	2	2	1	2		15	It is feasible to relocate and consolidate the CSO.
Pump Station Modifications										0	0	There are no CSO Control pump stations in the basin to modify.
Static Flow Control	1	1	2	2	2	2	0	0	2		0	Permanently raising the weir/dam will ultimately raise the HGL in all upstream sewers making worse the WIB and Street Flooding issues.
Variable Flow Control	1	1	2	2	1	2	1	1	2		13	Variable control would be much preferred over static type improvements.
Real-Time Control	1	1	2	2	1	2	1	1	2		13	
Other (Add technology)											0	
Flow Reduction												
Stormwater Management	2	2	2	2	2	2	2	2	2		18	There are many different technologies which fall into this category, one or more of which will be suitable towards meeting the goals of the program. Upland detention is already in place, with additional detention presently under construction. In addition to bio-retention, inlet reconstruction, and other "green" solutions, another significant potential for flow reduction is detention in the Forest Lawn Area.
Inflow Reduction	2	2	2	2	2	2	2	2	2		18	Storm water in the Forest Lawn area is collected in a stream which drains directly into the Sharron Branch of the Minne Lusa Sewer. This is a potential location for Inflow Reduction. In addition, many areas tributary to the Minne Lusa CSO have previously separated storm water sewers which discharge back into the combined sewers. These inflow sources could be scalped from the combined system through a storm water collector tunnel.
Infiltration Reduction	1	1	1	2	2	2	2	2	1		14	
Sewer Separation - Full or Partial within Specified Geography	2	2	2	1	2	2	2	1	1		15	
Flow Slipping	1	1	1	2	1	1	1	1	2		11	
Other (Add technology)											0	
Storage												
Open Basins						0		0			0	Odor issues and doubtful permitablity are fatal flaws for this technology.
Closed Storage Tanks	2	2	1	1	1	2	2	1	1		13	Near surface storage is feasible, but would require the purchase of additional land.
Vertical Storage	2	2	1	1	1	2	2	1	1		13	
Storage Conduits	2	2	1	1	2	2	2	1	1		14	
Storage Tunnels	2	2	2	2	2	2	2	2	1		17	Also would be suitable to inter-basin storage, conveyance.
Existing Tunnels or Conduits (abandoned)										0	0	There are no existing, abandoned tunnels in the basin.
Other (Add technology)											0	
Satellite Treatment (2)												
Gross Solids Removal		0									0	Without a disinfection process the proposed treatment bundle does not address the need to control E. Coli.
Gross Solids Removal + Disinfection	2	1	2	2	2	1	2	2	1		15	While this treatment combination can not be ruled as a fatal flaw, it should be noted that EPA will not presume that the combination provides adequate treatment. Therefore additional monitoring, evaluation, etc. should be expected to demonstrate the adequacy of this technology.
Gross Solids Removal + Settleable Solids Removal		0									0	Without a disinfection process the proposed treatment bundle does not address the need to control E. Coli.
Gross Solids Removal + Settleable Solids Removal + Disinfection	2	2	2	2	2	2	2	2	1		17	Technology is available, siting a facility is also feasible, but would require purchasing land (the adjacent park at the power facility or the adjacent trailer court were discussed possibilities).
Gross Solids Removal + Settleable Solids Removal + Dissolved Solids Removal		0									0	Without a disinfection process the proposed treatment bundle does not address the need to control E. Coli.
Gross Solids Removal + Settleable Solids Removal + Dissolved Solids Removal + Disinfection	2	2	1	2	2	2	2	1	1		15	It is not anticipated that full secondary treatment will be required for CSO treatment.
Other (Add technology)											0	

Notes:
1. A "0" score indicates "fatal flaw", technology not viable at given location; Explain rationale specifically with comment.
2. Satellite wet weather treatment includes a variety of treatment trains depending on the pollutant removal required. The treatment trains are a progression of the purpose of individual technologies. Individual technologies per treatment category are provided in the Fact Sheets.

Technologies Screening Matrix

CSO Number: 106
CSO Location: North Interceptor (Minne Lusa Releif Sewer)

Scoring:
2 = Applicable at This Location
1 = Limited applicability
0 = "Fatal Flaw" - Not viable technology (1)

Technology	Screening Criteria: Reduces CSO volume significantly	Controls pollutants of concern	Site suitability	Constructibility	O&M feasibility	Permittability	Environmental, cultural or historical issues	Neighborhood impacts	Life Cycle Cost	Other (Specify)	Total Score	Comment/Rationale
Sewer System Modifications												
Flow Redirection	1	1	2	2	2	2	2	1	2		15	"Networking" in the system is feasible.
CSO Relocation	1	1	2	2	2	2	2	1	2		15	It is feasible to relocate and consolidate the CSO.
Pump Station Modifications										0	0	There are no CSO Control pump stations in the basin to modify.
Static Flow Control	1	1	2	2	2	2	0	0	2		0	Permanently raising the weir/dam will ultimately raise the HGL in all upstream sewers making worse the WIB and Street Flooding issues.
Variable Flow Control	1	1	2	2	1	2	1	1	2		13	Variable control would be much preferred over static type improvements.
Real-Time Control	1	1	2	2	1	2	1	1	2		13	
Other (Add technology)											0	
Flow Reduction												
Stormwater Management	2	2	2	2	2	2	2	2	2		18	There are many different technologies which fall into this category, one or more of which will be suitable towards meeting the goals of the program. Some upland detention is already in place, with additional detention presently under construction. Bio-retention, inlet reconstruction, detention, and other "green" solutions are suitable flow reduction options.
Inflow Reduction	2	2	2	2	2	2	2	2	2		18	Many areas tributary to the North Interceptor CSO have previously separated storm water sewers which discharge back into the combined sewers. These inflow sources could be scalped from the combined system through a storm water collector tunnel.
Infiltration Reduction	1	1	1	2	2	2	2	2	1		14	
Sewer Separation - Full or Partial within Specified Geography	2	2	2	1	2	2	2	1	1		15	
Flow Slipping	1	1	1	2	1	1	1	1	2		11	
Other (Add technology)											0	
Storage												
Open Basins						0		0			0	Odor issues and doubtful permitablity are fatal flaws for this technology.
Closed Storage Tanks	2	2	1	1	1	2	2	1	1		13	Near surface storage is feasible, but would require the purchase of additional land.
Vertical Storage	2	2	1	1	1	2	2	1	1		13	
Storage Conduits	2	2	1	1	2	2	2	1	1		14	
Storage Tunnels	2	2	2	2	2	2	2	2	1		17	Also would be suitable to inter-basin storage, conveyance.
Existing Tunnels or Conduits (abandoned)										0	0	There are no existing, abandoned tunnels in the basin.
Other (Add technology)											0	
Satellite Treatment (2)												
Gross Solids Removal		0									0	Without a disinfection process the proposed treatment bundle does not address the need to control E. Coli.
Gross Solids Removal + Disinfection	2	1	2	2	2	1	2	2	1		15	
Gross Solids Removal + Settleable Solids Removal		0									0	Without a disinfection process the proposed treatment bundle does not address the need to control E. Coli.
Gross Solids Removal + Settleable Solids Removal + Disinfection	2	2	2	2	2	2	2	2	1		17	The technology is certainly available. Siting a facility is also feasible, but may require purchasing additional land in addition to the Grace Street Ditch depending on the quantity of flow treated at this location. The adjacent concrete plant and an area which abuts the north side of Abbott Drive between 6th Street and the Grace Street Ditch were the leading possibilities discussed.
Gross Solids Removal + Settleable Solids Removal + Dissolved Solids Removal		0									0	Without a disinfection process the proposed treatment bundle does not address the need to control E. Coli.
Gross Solids Removal + Settleable Solids Removal + Dissolved Solids Removal + Disinfection	2	2	1	2	2	2	2	1	1		15	It is not anticipated that full secondary treatment will be required for CSO treatment.
Other (Add technology)											0	

Notes:
1. A "0" score indicates "fatal flaw", technology not viable at given location; Explain rationale specifically with comment.
2. Satellite wet weather treatment includes a variety of treatment trains depending on the pollutant removal required. The treatment trains are a progression of the purpose of individual technologies. Individual technologies per treatment category are provided in the Fact Sheets.

Technologies Screening Matrix

CSO Number: 107
CSO Location: Grace Street

Scoring:
2 = Applicable at This Location
1 = Limited applicability
0 = "Fatal Flaw" - Not viable technology (1)

Technology	Screening Criteria: Reduces CSO volume significantly	Controls pollutants of concern	Site suitability	Constructibility	O&M feasibility	Permittability	Environmental, cultural or historical issues	Neighborhood impacts	Life Cycle Cost	Other (Specify)	Total Score	Comment/Rationale
Sewer System Modifications												
Flow Redirection	1	1	2	2	2	2	2	1	2		15	"Networking" in the system is feasible.
CSO Relocation	1	1	2	2	2	2	2	1	2		15	It is feasible to relocate and consolidate the CSO.
Pump Station Modifications										0	0	There are no CSO Control pump stations in the basin to modify.
Static Flow Control	1	1	2	2	2	2	0	0	2		0	Permanently raising the weir/dam will ultimately raise the HGL in all upstream sewers making worse the WIB and Street Flooding issues.
Variable Flow Control	1	1	2	2	1	2	1	1	2		13	Variable control would be much preferred over static type improvements.
Real-Time Control	1	1	2	2	1	2	1	1	2		13	
Other (Add technology)											0	
Flow Reduction												
Stormwater Management	2	2	2	2	2	2	2	2	2		18	There are many different technologies which fall into this category, one or more of which will be suitable towards meeting the goals of the program. Bio-retention, inlet reconstruction, detention and other "green" solutions are suitable flow reduction options.
Inflow Reduction	2	2	2	2	2	2	2	2	2		18	
Infiltration Reduction	1	1	1	2	2	2	2	2	1		14	
Sewer Separation - Full or Partial within Specified Geography	2	2	2	1	2	2	2	1	1		15	
Flow Slipping	1	1	1	2	1	1	1	1	2		11	
Other (Add technology)											0	
Storage												
Open Basins						0		0			0	Odor issues and doubtful permitablity are fatal flaws for this technology.
Closed Storage Tanks	2	2	1	1	1	2	2	1	1		13	Near surface storage is feasible, but would require the purchase of additional land.
Vertical Storage	2	2	1	1	1	2	2	1	1		13	
Storage Conduits	2	2	1	1	2	2	2	1	1		14	
Storage Tunnels	2	2	2	2	2	2	2	2	1		17	Also would be suitable to inter-basin storage, conveyance.
Existing Tunnels or Conduits (abandoned)										0	0	There are no existing, abandoned tunnels in the basin.
Other (Add technology)											0	
Satellite Treatment (2)												
Gross Solids Removal		0									0	Without a disinfection process the proposed treatment bundle does not address the need to control E. Coli.
Gross Solids Removal + Disinfection	2	1	2	2	2	1	2	2	1		15	
Gross Solids Removal + Settleable Solids Removal		0									0	Without a disinfection process the proposed treatment bundle does not address the need to control E. Coli.
Gross Solids Removal + Settleable Solids Removal + Disinfection	2	2	2	2	2	2	2	2	1		17	The technology is certainly available. Siting a facility is also feasible, but may require purchasing additional land in addition to the Grace Street Ditch depending on the quantity of flow treated at this location. The adjacent concrete plant and an area which abuts the north side of Abbott Drive between 6th Street and the Grace Street Ditch were the leading possibilities discussed.
Gross Solids Removal + Settleable Solids Removal + Dissolved Solids Removal		0									0	Without a disinfection process the proposed treatment bundle does not address the need to control E. Coli.
Gross Solids Removal + Settleable Solids Removal + Dissolved Solids Removal + Disinfection	2	2	1	2	2	2	2	1	1		15	It is not anticipated that full secondary treatment will be required for CSO treatment.
Other (Add technology)											0	

Notes:
1. A "0" score indicates "fatal flaw", technology not viable at given location; Explain rationale specifically with comment.
2. Satellite wet weather treatment includes a variety of treatment trains depending on the pollutant removal required. The treatment trains are a progression of the purpose of individual technologies. Individual technologies per treatment category are provided in the Fact Sheets.