PROJECT NAME: *W. Lincoln & N. Cascade San. Sewer Improvements*
FILE No: *2009-057-21* **BID No:** *2010-07*
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ISSUED BY: *Duane K. Barrick – Project Manager*
REPORT NO.: **Three (3)**

QUESTIONS:

1. There is no Technical Specification Section 6550 – Sanitary Sewer Manhole Rehabilitation, bound with in the document set.

CLARIFICATION:

1. All the City of Woodburn's Standard Technical Specifications and Standard Drawings are available in PDF form on the Engineering Division website.
2. Section 6550 is included herein.

ATTACHMENT

Standard Technical Specification Section –
“ 6550 Sanitary Sewer Manhole Rehabilitation”

PART 1 GENERAL

1.1 SCOPE:

A. This item shall govern all work, materials, tools and equipment required for structure rehabilitation, for the purpose of eliminating infiltration, providing corrosion protection, repair of voids, and restoration of the structural integrity of the structure as a result of applying a monolithic fiber-reinforced structurally enhanced cementitious liner to the wall and bench surfaces of existing manhole structures.

B. Described are procedures for cleaning, preparation, application and testing. The applicator, approved and trained by the manufacturer, shall furnish all labor, equipment, tools and materials for applying a cementitious mix to form a structural monolithic liner of material. All aspects of the installation shall be in accordance with the manufacturer's recommendation and per the following specifications, which includes;

1. The removal of any loose and unsound material.
2. Cleaning of the area to be sprayed with high pressure water.
3. The repair and filling of voids.
4. The repair and sealing of the invert and benches.
5. The elimination of active infiltration prior to making the application.
6. The spray application of the cementitious mix to form a structurally enhanced monolithic liner.

1.2 QUALITY ASSURANCE:

A. Product must have a minimum of 5 year history of being used for reconstruction of and in a sanitary sewer system. Manufacturer must provide a list of manhole projects completed during the past 5-years. Any product proposed must have been successfully demonstrated to the satisfaction of the Engineer and approved as an equal prior to bid opening.

B. Applicator must be factory trained and provide a copy of certification acknowledging status as being an approved applicator.

PART 2 PRODUCTS

2.1 GENERAL:

A. The use of a manufacturer's name and product is for the purpose of establishing the standard of quality and general configuration desired. Products of other manufacturer's with similar processes and quality will be considered as an approved equal.

2.2 PATCHING MATERIAL:

A. StrongSeal® QSR (or approved equal), a quick setting, fiber reinforced, calcium aluminate, corrosion resistant cementitious material, shall be used as a patching material and is to be mixed and applied according to the manufacturer's recommendations, and shall have the following minimum requirements;

CHARACTERISTIC	STANDARD	MINIMUMS
Compressive Strength	ASTM C 109	1400 psi in 6 hours
Bond	ASTM C 321	145 psi in 28 days
Cement		Sulfate Resistant
Applied Density		105 lbs. ± 5 lbs. pcf
Shrinkage	ASTM C 596	0% at 90% RH

2.3 INFILTRATION CONTROL MATERIAL:

A. Strong Seal®, Strong-Plug (or approved equal), a rapid setting cementitious product specifically formulated for leak control, shall be used to stop minor water infiltration and shall be mixed and applied according to manufacturer's recommendations, and shall have the following minimum requirements;

CHARACTERISTIC	STANDARD	MINIMUMS
Compressive Strength	ASTM C 109	400 – 600 psi in 1 hour, 1800 – 2400 psi in 24 hours
Expansion	ASTM C 827	10%
Sulfate Resistance	ASTM C 267	No wt. Loss after 15cycles, 2000 ppm; test continuing
Freeze/Thaw	ASTM C 666 Method "A"	100 cycles
Pull out Strength	ASTM C 234	14,000 lbs
Placement Time	--	<1.0 minute

2.4 GROUTING MATERIAL:

A. Strong Seal®, Grout 250 (or approved equal), a cementitious grout, shall be used for stopping active infiltration and filling voids and shall be mixed and applied in accordance with the manufacturer's recommendations. The cementitious grout shall be volume stable, and have a minimum 28-day compressive strength of 250 psi.

B. Strong Seal®, Grout 1000 (or approved equal), a cementitious grout, shall be used for same application as Grout 250, but is designed for special soil conditions, and shall be used per manufacturer's recommendations. The cementitious grout shall be volume stable and have a minimum 28-day compressive strength of 1000 psi.

C. Chemical grouts may be used to stop excessively active infiltration and shall be mixed and applied per the manufacturer's recommendations.

2.5 LINER MATERIAL:

A. Strong Seal®, (or approved equal), cementitious-based liner products shall be used to form a structurally enhanced monolithic liner covering all interior structure surfaces and shall have the following minimum requirements at 28-days.

CHARACTERISTIC	STANDARD	MINIMUMS
Compressive Strength	ASTM C 109	> 4000 psi
Tensile Strength	ASTM C 496	> 300 psi
Flexural Strength	ASTM C 78	> 600 psi
Shrinkage @ 90% RH	ASTM C 596	0%
Bond	ASTM C 952	. 130 psi
Density, when applied		105 pcf ± 5 lbs

B. Strong Seal® MS-2A (or approved equal), shall be made with Type I or Type III Portland Cement and shall be used according to manufacturer's recommendations in applications where there is no or very mild sulfide conditions (pH 3.0 or higher).

C. Strong Seal® MS-2A, (or approved equal), product shall be factory blended, requiring the addition of water at the job site. The bag weight shall be 50-51 lbs. The cement content shall be 50%-60% of the total weight of the bag. The content shall have a dry bulk density of 54-56 pcf. Wet density not to exceed that indicated in the above table and shall yield a minimum of 0.63 cubic foot of volume per bag.

D. All Strong Seal® products shall be reinforced with alkaline resistant fiberglass rods not less then ½-inch in length nor greater then 5/8-inches in length.

E. **The Material should meet or exceed industry standards and shall not have any basic ingredient that exceeds EPA maximum allowable limit(s) for any heavy metal.**

2.6 WATER:

A. Water used to mix product shall be clean and potable. Questionable water shall be tested by a laboratory in accordance with ASTM C 94 procedures. Potable water will not require testing.

2.7 OTHER CHEMICALS:

A. No other material shall be used with the mixes described in Part 2 without prior written approval of Strong Seal® Systems.

2.8 EQUIPMENT:

A. Applicator must use approved equipment (designed and manufactured by the material supplier) specifically for the application of cementitious liners in sanitary sewer system manholes.

B. Specially designed machines consisting of an optimized progressive cavity pump capable of producing a minimum of 250 psi pumping pressure, patented contra-blend mixer with twin

ribbon paddles and end discharge or a Strong Seal® continuous mixer, and an air system for low velocity spray application of product, shall be used for applying Strong Seal® Systems products. Equipment is complete with water storage and metering system. Mixer and pump are hydraulically powered. SprayMate® models35C and 35D or the Strong Seal® MiniMate™ are approved machines for applying Strong Seal® System products.

PART 3 EXECUTION

3.1 PREPARATION:

A. Place covers over invert to prevent extraneous material form entering the sewer lines.

B. All foreign material shall be removed from the manhole wall and bench using a high pressure water spray (minimum of 1200 psi). Loose and protruding brick, mortar, and concrete shall be removed using a mason's hammer and chisel and/or scraper. Fill any large voids with quick setting patching mix as specified in Section 2.2, herein.

C. Active leaks shall be stopped using quick setting, specially formulated mixes (Strong-Seal® QSR or Strong-Seal® StrongPlug or approved equal) according to manufacturer's recommendations. Some leaks may require weep holes to localize the infiltration during the application. After application, the weep holes shall be plugged with quick setting material (StrongPlug, or approved equal) prior to the application of the final coat. When severe infiltration exists, drilling may be required in order to pressure grout using a cementitious grout, see Section 2.4 herein. Manufacturer's recommendations shall be followed when pressure grouting is required.

3.2 INVERT REPAIRS:

A. After all preparations have been completed, remove all loose material and wash wall again.

B. Any bench, invert or service line repairs shall be made using the quick setting StrongSeal® QSR (or approved equal) and shall be installed per the manufacturer's recommendations.

C. Invert repair shall be performed on all inverts with visible damage or where infiltration is present or when vacuum testing is specified. After blocking flow through the manhole, and thoroughly cleaning the invert, the quick setting patch material shall be applied to the invert and bench in an expeditious manner. The material shall be troweled uniformly onto the damaged invert at a minimum thickness of ½-inch at the invert extending out onto the bench of the manhole sufficiently to tie into the structurally enhanced monolithic liner. The finish invert surfaces shall be smooth and free of ridges and shall be tapered at the inlets and outlet of the channel for flow. The flow may be reestablished in the manhole within 30-minutes after placement of the material is completed.

3.3 MIXING LINER MATERIALS:

A. For each bag of product, use the amount of water or water settings required per manufacturer's recommendations, following mixing procedures noted on the product bag and using the approved equipment for mixing the application.

B. Prepared mix shall be discharged into a hopper and mixing shall continue to occur in such a manner as to allow spraying continuously, without interruption until each application is completed.

3.4 SPRAYING:

A. BASE COAT APPLICATION: The surfaces shall be clean and free of all foreign material and shall be damp without noticeable free droplets of running water, but totally saturated, just prior to application. Materials shall be spray applied from the bottom to the wall to the top, using as many passes as necessary. The surface is to be rough troweled after each pass. The light troweling is performed to assure the material penetrates the voids and sets the bond.

B. FINAL APPLICATION: A final application, mixed per specifications as per Section 2.4 shall be applied after the base coat applications have been rough troweled. Manufacturer's recommendations shall be followed whenever more then 24-hours have elapsed between applications. The final application shall be applied to assure a minimum total thickness of ½-inch. Again, application shall be from the bottom up. The surface is then troweled to a relatively smooth finish, being careful not to over trowel. A brush finish is then applied to the troweled finish or top coat surface.

C. BENCH APPLICATION: The wooden coves shall be removed at this time and the bench sprayed with materials mixed per specifications as per Section 3.3 and spray applied in such a manner that a gradual slope is produced from the walls to the invert with the thickness at the invert to be no less than ½-inch. The wall/bench intersections shall be rounded to a uniform radius the full circumference of the intersection.

3.5 CURING:

A. Caution should be taken to minimize exposure of applied product to sunlight and air movement. If the time between applications of additional coats is to be longer than 15-minutes, the structure shall be covered. At no time should the finished product be exposed to sunlight or air movement for longer then 15-minutes before covering or closing access. In extremely hot and arid climates, manhole shall be shaded while reconstruction is in process and a concrete curing agent should be used if humidity level is less then 70% within the manhole. Curing compounds shall conform to ASTM C309 and be approved prior to application.

B. The final application of StrongSeal® liner products shall have the following minimum cure times before being subjected to flows:

Hold time before releasing flow, MS-2A

Storm Run-off and surcharge	8-Hours
Sanitary Sewers	12-Hours

C. After final application of the StrongSeal® liner product, traffic shall be held 24-hours. Where it is not practical to defer traffic for 24-hours (as directed by the Engineer), and/or when the manhole is an outfall for a force-main, a high performance calcium aluminate based StrongSeal® product shall be used.

3.6 WEATHER:

A. No application shall be made if ambient temperature is below 40^{o}F. No application shall be made to frozen surfaces or if freezing is expected to occur within the structure within 24-hours after application.

B. Precautions shall be taken to keep the mix temperature, at time of application, below 90^{o}F. Water temperature shall not exceed 80^{o}F. Chill with ice if necessary.

PART 4 TESTING

4.1 GENERAL:

A. Four (4) 2-inch cubes shall be cast each day or from every pallet of product used and shall be properly packaged, labeled and either returned to the manufacturer or sent to a certified, independent lab for testing for compression strength per ASTM C109 procedure.

4.2 VACUUM TESTING:

A. Manhole testing shall be accomplished by means of vacuum test methods as conforms to ASTM C 1244 and is herein specified.

B. All sewer lines shall be securely plugged.

C. Apply 10-inches Mercury (Hg) to the sealed manhole and track the time it takes the vacuum to drop to 9-inches Hg.

D. Acceptance of the individual manhole will be based on the following chart:

	TIME (sec)		
DEPTH (ft)	**48”**	**60”**	**72”**
8	14	18	23
10	17	23	28
12	21	28	34
14	25	32	40
16	28	37	45
18	32	41	51
20	35	46	27
22	39	51	62
24	42	55	68

E. Manholes shall be sealed, resealed and tested until they pass vacuum testing as described and observed by the Engineer.

END OF SECTION