

**PRELIMINARY
DESIGN MEMORANDUM**

**BEAL SLOUGH RELIEF TRUNK SEWER
PHASES I & II
LINCOLN, NEBRASKA - 2003**

PREPARED FOR

LINCOLN WASTEWATER SYSTEM

LINCOLN, NEBRASKA

OCTOBER 2003

B&V PROJECT NO. 134056.0202



OLSSON ASSOCIATES
ENGINEERS • PLANNERS • SCIENTISTS • SURVEYORS

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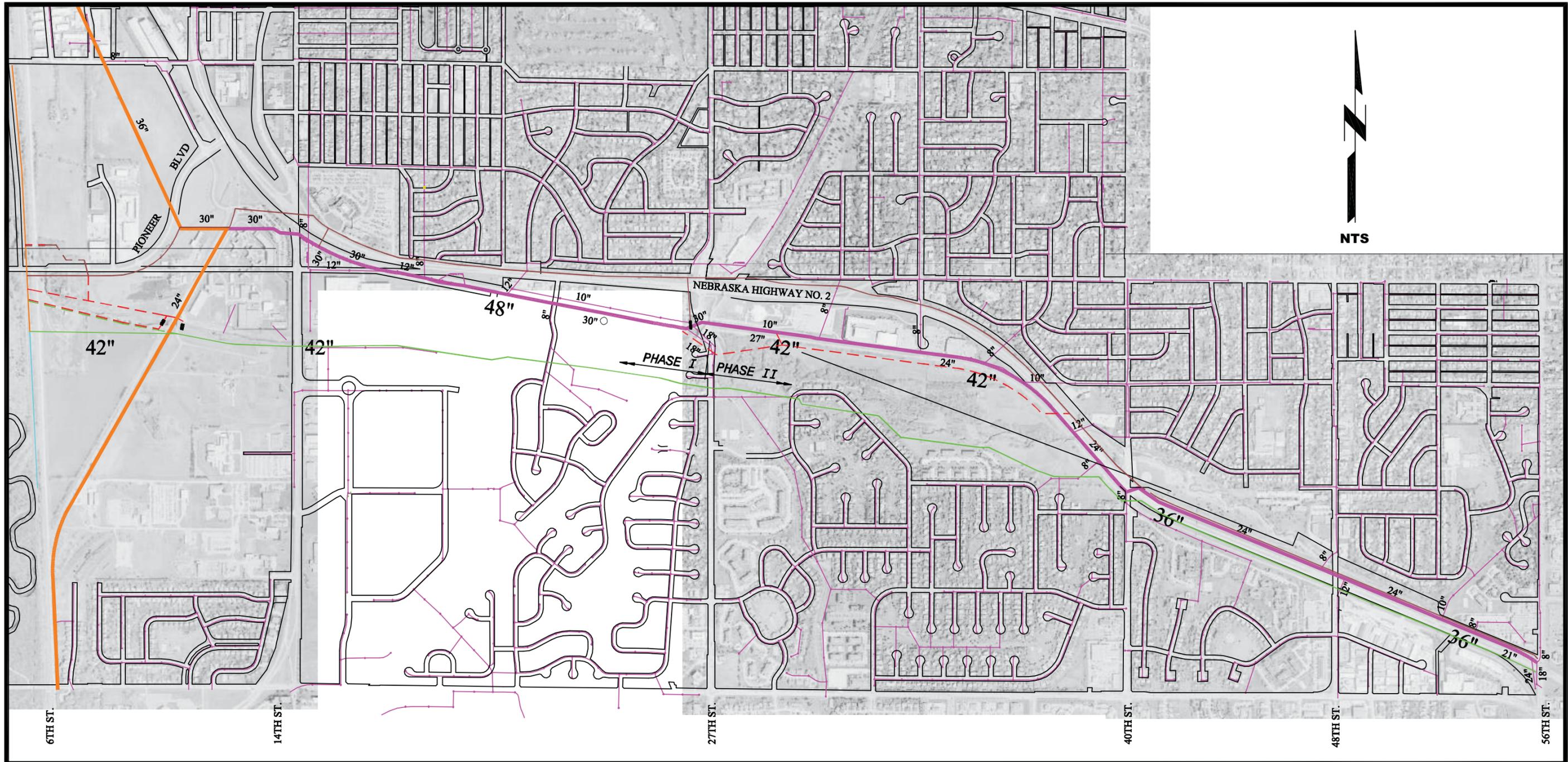
I. GENERAL

A. Project Description

The Beal Slough Relief Trunk Sewer Phases I & II, includes the preparation of Contract Documents for the construction of approximately 21,140 linear feet of gravity sewer. The existing Beal Slough Trunk Sewer, shown on Figure 1, begins at the northwest corner of Highway 2 and 56th Street and extends west adjacent to Highway 2 and the Beal Slough to the connection with the Salt Valley Trunk Sewer west of the State Penitentiary. The existing sewer ranges in size from 21 to 30 inches in diameter and is 18,800 feet in length, with materials of construction consisting primarily of vitrified clay pipe with small portions of reinforced concrete pipe and cast iron pipe. The existing sewer is overloaded during wet weather events and is not sized for anticipated future development. To resolve these issues the LWWS intends to design and construct a parallel replacement sewer to convey peak wastewater flow for ultimate development of the Beal Slough drainage basin and abandon the existing sewer in-place.

The Beal Slough Relief Trunk Sewer will be constructed in two phases. Phase I is to extend from its connection at the Salt Valley Relief Trunk Sewer at 6th Street to approximately 27th Street and Highway 2. Phase II is to extend from 27th Street and Highway 2 to 56th Street and Highway 2. Downstream sections in the Salt Valley Trunk Sewer system are being upgraded prior to capacity relief being provided in the Beal Slough sewer. Phase IV of the Salt Valley Relief Trunk Sewer will be constructed in spring 2004, prior to Phase I of the Beal Slough Relief Trunk Sewer, thus eliminating downstream surcharge concerns. LWWS recently completed the installation of a 24 inch relief sewer at Highway 2 and 56th Street which conveys flow from southern portions of the drainage basin into the Beal Slough Trunk Sewer.

The existing Salt Valley Trunk Sewer begins in southwest Lincoln and conveys flow north and eastward to the Theresa Street Wastewater Treatment Plant for a total distance of 8.6 miles. The sewer parallels Salt Creek for the entire length and ranges in size from 24 to 60 inches in diameter. Major laterals connecting to the Salt Valley Trunk Sewer include the Beal Slough, Campus Feed, and Antelope Creek sewers. Surcharging of the existing line occurs during heavy rainfall events from inflow and infiltration through leaky joints, manholes, and pipes. To eliminate the surcharging



LEGEND

-  EXISTING SALT VALLEY TRUNK SEWER
-  EXISTING BEAL SLOUGH TRUNK SEWER
-  EXISTING SEWERS
-  STREETS

City of Lincoln, NE
**Beal Slough Relief Trunk Sewer
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**Existing Beal Slough
 and Salt Valley Sewers**
 October 2003



Figure 1

and provide for future growth, LWWS is conducting an improvement program to parallel the existing Salt Valley Trunk Sewer with a relief sewer constructed in five phases. Phases I and IIA, at the north end near the WWTP, have been constructed and Phases IIB and IIIA were bid in May of 2003. Phase IV, designed by Olsson Associates, will be constructed in 2004 and will include a location for connecting the Beal Slough Relief Trunk Sewer-Phase I.

B. Project Team Organization

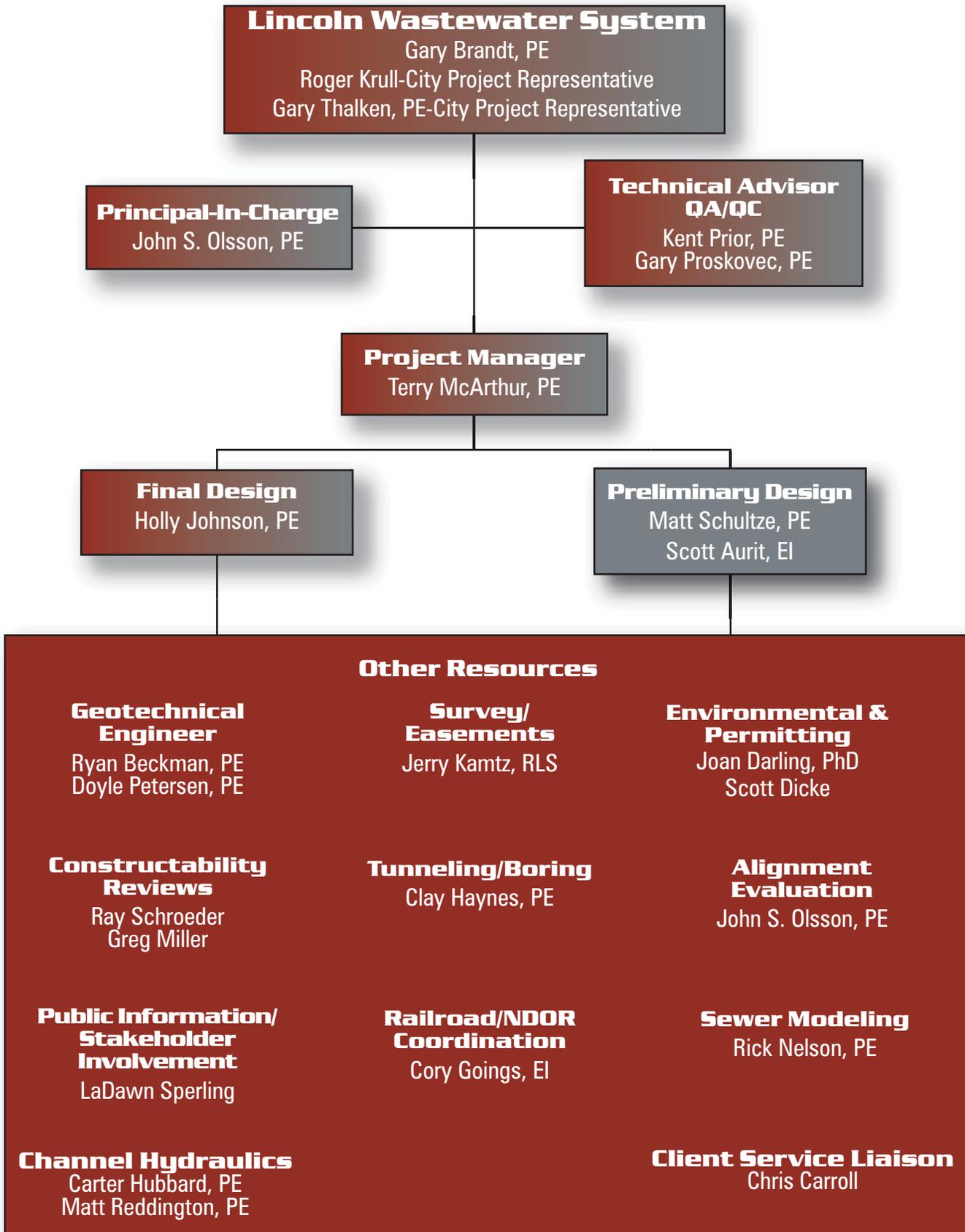
The Lincoln Wastewater System (LWWS) is an integral partner in the development of the concepts, design, and construction of all project elements. Mr. Roger Krull and Mr. Gary Thalken are the designated Project Representatives for LWWS.

Olsson Associates (OA), Lincoln, NE office, is the lead Engineer and Black & Veatch (B&V) and HWS Consulting Group (HWS) are subconsultants to OA for this project. B&V will perform the alignment study and preliminary design and OA will provide the final design of the Beal Slough Relief Trunk Sewer Phase I. Phase II final design will be awarded at a later time. OA staff will also provide project resources for:

1. Geotechnical exploration for Phase II
2. Constructibility Reviews
3. Public Information & Stakeholder Involvement
4. Survey/Easements
5. Railroad/NDOR Coordination
6. Environmental & Permitting

B&V conducted the alignment evaluation and will provide project resources for constructibility reviews, technical assistance for tunneling, and boring. HWS will provide geotechnical drilling, testing and QA/QC services for Phase I. An organizational chart is shown on Figure 2, identifying individuals and their duties for both Salt Valley and Beal Slough relief sewer projects.

Salt Valley Relief Sewer-Phase IV
Beal Slough Relief Sewer-Phase I & II
Organizational Chart



C. Site Description1. Location

Phase I of the Beal Slough Relief Trunk Sewer begins at the connection to the Salt Valley Trunk Sewer south of Pioneers Blvd and west of Beal Slough. It crosses beneath the BNSF railroad tracks and continues east paralleling the LES Easement south of Beal Slough through a proposed 30 foot permanent easement. The sewer then crosses beneath Beal Slough directly east of the BNSF railroad line on Correctional Services property, then turns east in a proposed 30 foot permanent easement to 14th Street. From 14th Street, it continues along the north side of Beal Slough and turns north along the east edge of Fleming Foods property through a proposed 30 foot permanent easement. At Pioneers Blvd, the sewer extends east through an easement north of Budget Self Storage, Cambell Industries, and the Lincoln Electric System (LES) substation. It continues through Peterson Park to 27th Street and connects to the two existing 18 inch sewers prior to tunneling beneath the BNSF railroad tracks and 27th Street. The sewer ends on the east side of 27th Street. The total length of Phase I is 9,411 feet with 6 tunnels of 815 feet in total length.

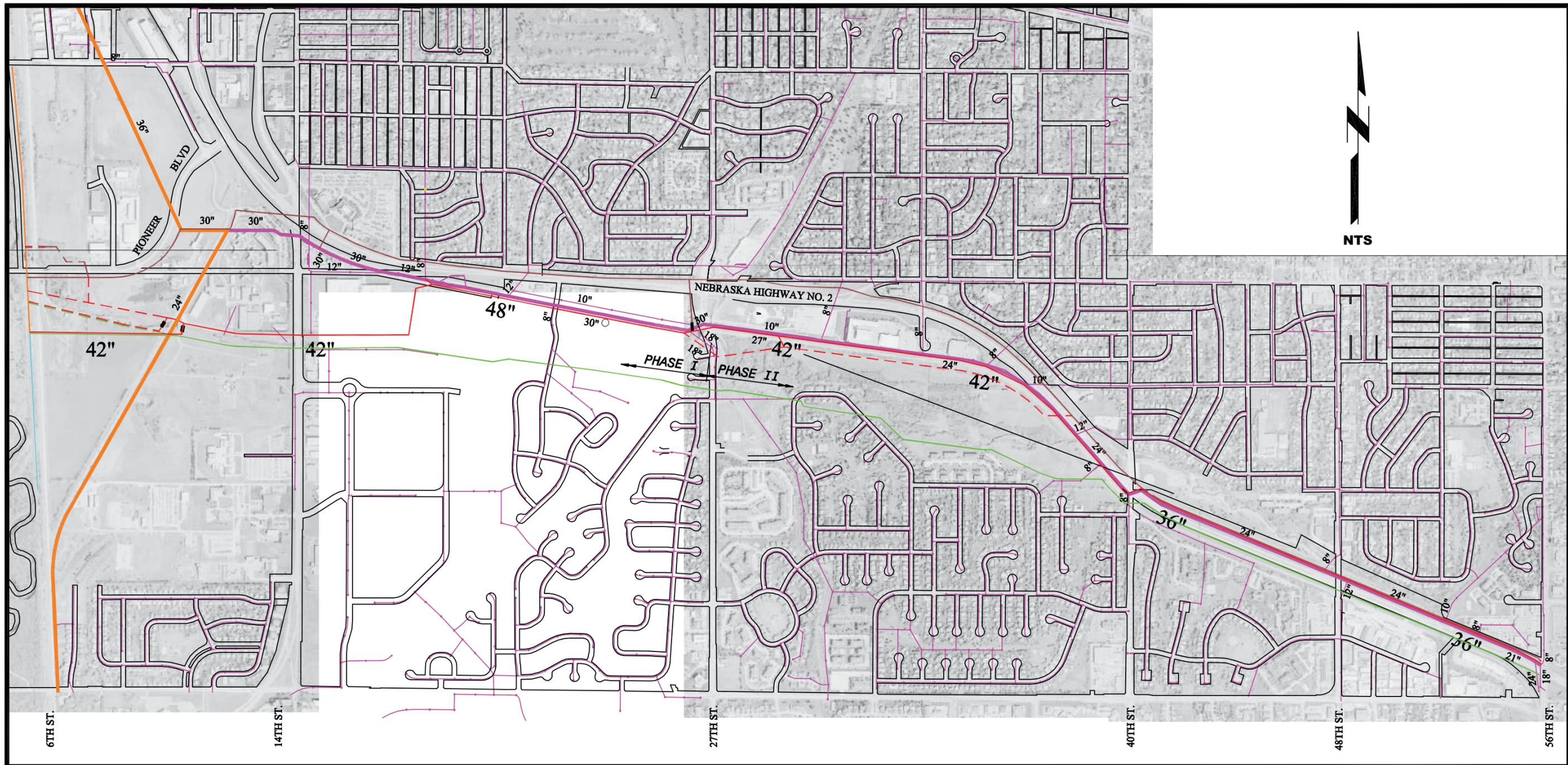
Phase II of the Beal Slough Relief Trunk Sewer begins on the east side of 27th Street and parallels the north side of the BNSF railroad tracks to 40th Street. At 40th Street, it crosses beneath Highway 2 and 40th Street and continues east to 56th Street. It connects to the existing 18 inch and 24 inch sewers on the northwest corner of 56th Street and Highway 2. The total length of Phase II is 11,694 feet with 2 tunnels of 290 feet in total length. The project locations for Phase I and Phase II are shown on Figure 3

2. Datum

Elevations will be based on 1988 North American Vertical Datum (NAVD). Horizontal control will be based on the Lancaster County grid control system.

3. Flood Protection

Flood elevations for Salt Valley and Beal Slough will be determined using



LEGEND

-  EXISTING SALT VALLEY TRUNK SEWER
-  EXISTING BEAL SLOUGH TRUNK SEWER
-  EXISTING SEWERS
-  STREETS
-  BEAL SLOUGH RELIEF TRUNK SEWER
-  SALT VALLEY - PHASE IV

City of Lincoln, NE
**Beal Slough Relief Trunk Sewer
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Project Location Map
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Figure 3

the “Lancaster County and Incorporated Areas Flood Insurance Study” and the “Flood Insurance Rate Maps.” The latest version of both references is September 21, 2001. Flood elevations will vary along the proposed Beal Slough Relief Trunk Sewer route for the given storm return intervals of 10-year, 50-year, 100-year and 500-year.

Vents for sewer manholes shall be constructed one foot above the 100-year flood elevation at each of the respective locations.

D. Geotechnical Investigations

A geotechnical investigation will be conducted by HWS for Phase I from approximately 6th Street and Pioneers Blvd. to 27th Street. OA will conduct a geotechnical investigation for Phase II from 27th Street east to 56th Street and Highway 2. HWS Consulting will be providing the drilling services for each phase. Soil borings should be taken at 800-1,000 foot intervals with additional borings taken at tunnels and near existing structures. Piezometer tests should be taken along the Beal Slough south of the State Penitentiary, in Peterson Park, and near the 40th Street tunnel.

E. Cultural Resources and Wetlands

The Lincoln/Lancaster County Planning Department has investigated the proposed alignment locations and has indicated that no historic resources exist in the area. The State Historical Preservation Office has recommended an archaeological survey to be conducted along the Beal Slough corridor from 6th Street to 15th Street.

Wetlands are located north of Cambell Ind. and north of the BNSFRR tracks near Star City Shores. Installation of the sewer through the wetlands will require a utility crossing indicating replacement of the wetlands after construction is complete.

F. Environmental Assessment

A search of environmental records was completed with Environmental Data Resources, Inc. (EDR) to determine if the sewer alignment will be located in a listed hazardous waste site.

The EDR report examined environmental records within a one-mile radius of the site for any potentially adverse environmental conditions. Each record was reviewed for present and former facilities. Environmental records reviewed by the EDR report are listed below:

- Comprehensive Environmental Response, Compensation, and Liability Index System (CERCLIS) and National Priorities List (NPL).
- Resource Conservation And Recovery Act Information System (RCRIS) for facilities that generate or transport and those facilities that treat, store, or dispose of hazardous waste.
- Registered solid waste landfills for both closed and operating.
- Underground Storage Tanks (USTs)
- Leaking Underground Storage Tanks (LUSTs)
- EPA Region VII emergency response notification system (ERNS), which is a listing of CERCLA hazardous releases or spills in quantities greater than the reportable quantity.
- The Nebraska Department of Environmental Quality (NDEQ) Surface Spills List (SPILLS), which is a listing of releases of petroleum or hazardous substances to the air, land, or water
- A memorandum, submitted to LWWS on June 23, 2003, indicating the findings of the EDR report is included in Appendix “A.” Several sites are listed within a one-mile radius of the site, however, the record review indicated only two areas of environmental concerns directly along the proposed alignment.

G. Topographic Survey, Easements, and Material Laydown Areas

OA will provide surveying services for the preparation of a topographic site survey for design and descriptions of permanent and temporary construction easements. Permanent construction easement requirements for sewer construction are determined based on a 1:1 slope from the springline of the of the sewer to existing grade. The average depth of the sewer is 16.5 feet; therefore, the average permanent easement is 30 feet. The temporary construction easement for the project is 70 feet, except for the alignment west of the Beal Slough crossing near Salt Valley-Phase IV. Two thirds of the temporary easement will be utilized on one side of the sewer and one third will be located on the other side. This will allow easier access for construction activities. The side of the sewer with the larger temporary easement will vary along the alignment. The sewer, west of the Beal Slough crossing to the connection with Salt Valley-Phase IV, will require 120 feet of total easement to account for the greater excavation depths.

Staging areas for Phase I shall include the State Penitentiary land south of the Beal Slough and Park and Recreation land west of Southwood Blvd. Staging areas for Phase II shall include Park and Recreation land south of the BNSF railroad tracks from 27th Street to 40th Street and portions of the park near 40th Street and Highway 2, east of the baseball diamond.

Property associated with Fleming Foods may be an issue for easement acquisition as the City of Lincoln owns the land in title. This issue will be resolved during final design.

H. Documents

1. Drafting Standards

The project drawings will be prepared on 22-inch by 34-inch sheets. A combination of OA drawing standards and the City of Lincoln's proposed drafting standards will be utilized in the preparation of project drawings. The City's proposed standards will be utilized to the extent feasible for

this project. Drawings will be produced using Microstation. Each sheet will have either of the following titles:

Beal Slough Relief Trunk Sewer Phase I
Lincoln, Nebraska
2004

Beal Slough Relief Trunk Sewer Phase II
Lincoln, Nebraska
2006

2. Specifications

OA technical specifications will be utilized in conjunction with City of Lincoln front end documents to develop project specifications. City technical specifications and details will be utilized as appropriate. Project specifications shall be similar to the documents prepared for Salt Valley Trunk Sewer, Phase IIB & IIIA and Phase IV.

3. Existing Data

The following data shall be used in the preparation of the Contract drawings and specifications:

- a. Lincoln Wastewater Facilities Plan Update - April 2003 prepared by Brown and Caldwell.
- b. Salt Valley Trunk Relief Sewer Improvements, Phases I through V - September 1998 Final Report prepared by Montgomery Watson.
- c. Engineering Report, City of Lincoln Wastewater System, Lincoln, Nebraska, March 1999 prepared by OA.
- d. Issue Papers: "Hydraulic Design" and "Pipe Materials," Salt Valley Trunk Sewer Phase IIB, Lincoln, Nebraska, OA Project No. 2001-0399 as prepared by Olsson Associates.

- e. Contract Documents for Salt Valley Trunk Sewer - Phase IIB & IIIA, Lincoln, Nebraska, 2003 prepared by OA.
- f. Contract Documents for Salt Valley Trunk Sewer - Phase IV, Lincoln, Nebraska, 2004 prepared by OA.
- g. Beal Slough Relief Trunk Sewer Phases I & II Alignment Study Report, October 2003, prepared by Black & Veatch.

I. Applicable Standards and Guidelines

The following standards and guidelines will be used for this project:

- 1. City of Lincoln Standard Plans and Specifications.
- 2. Recommended Standards for Wastewater Facilities, Great Lakes - Upper Mississippi River Board of State Public Health and Environmental Managers (10 States Standards).

J. Project Approval Requirements

The following agencies will review and approve the Contract Documents prior to Awarding the project for construction:

- 1. Nebraska Department of Environmental Quality for minimum sanitary requirements.
- 2. Lower Platte South Natural Resources District and U.S. Corps of Engineers for construction of a check weir in Beal Slough and miscellaneous improvements of the channel banks along the south portion of the State Penitentiary.
- 3. Burlington Northern Santa Fe Railroad for undercrossing a railroad right-of-way.

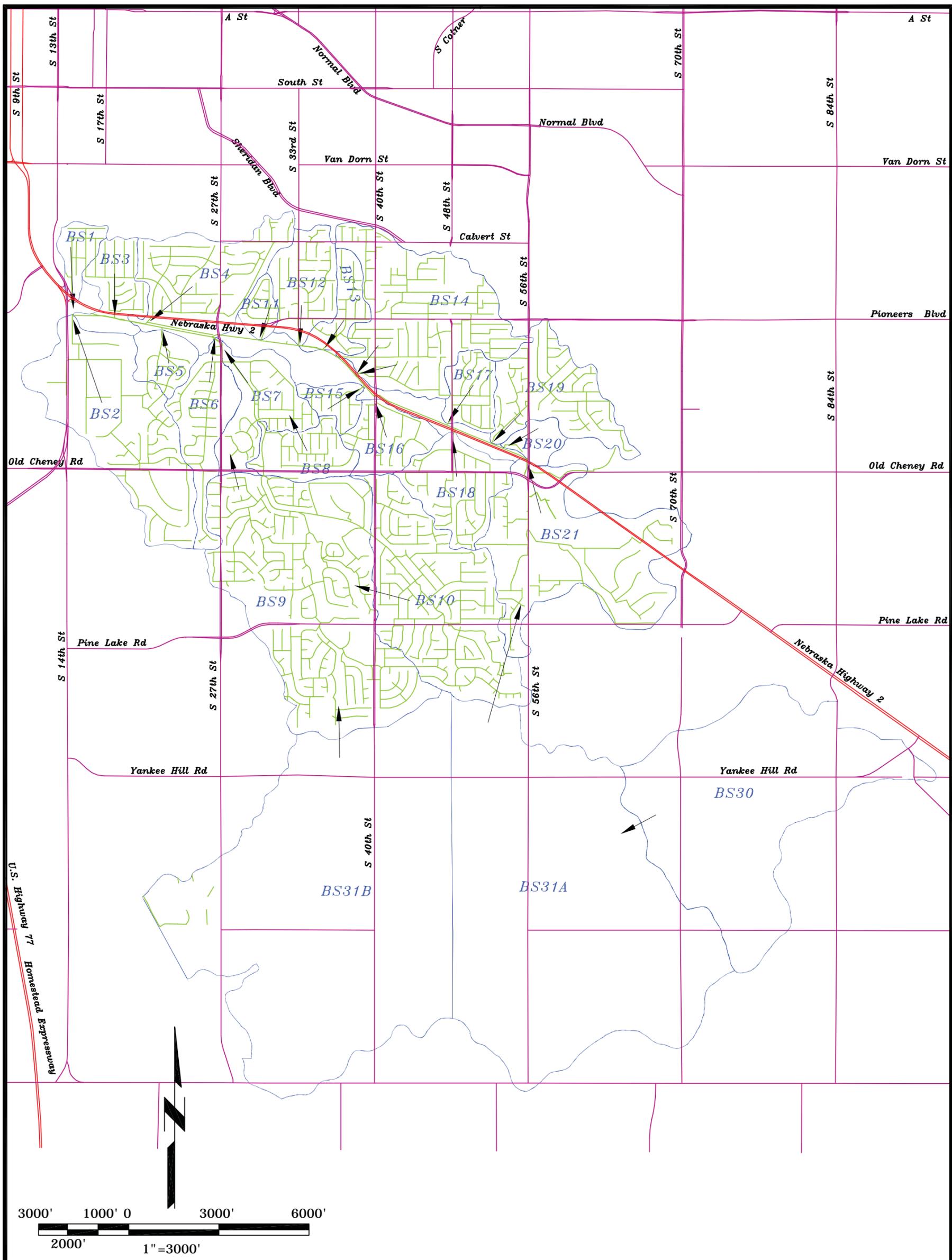
4. Nebraska Department of Roads for construction in the right-of-way and tunnel crossing of Highway 2.
5. National Pollutant Discharge Elimination System (NPDES) Permit for control of run-off during construction.

II. SEWER DESIGN

A. Sewer Service Areas

The Tier I service areas identified in the *Lincoln Wastewater Facilities Plan Update* (October 31, 2002, by Brown and Caldwell) were used as the sewer service areas for the design. This document indicates a total Tier I sewer service area of 9,781 acres for Beal Slough. The manholes listed in Table 1 show the location of the incoming subsystem areas, as shown in Figure 4, to the existing Beal Slough Trunk sewer. This data was utilized size the new Beal Sough Relief Trunk Sewer.

Table 1 - Wastewater Model Flow Input Locations				
Manhole	Subsystem	Area (acres)	Peak Flow (cfs)	Peak Flow (mgd)
3	BS21, 31A & 30	3,607	22.920	14.818
13	BS20	51	0.554	0.358
14	BS19	275	2.369	1.531
17	BS17 & 18	304	2.584	1.671
42	BS16	130	1.238	0.800
43	BS15	55	0.591	0.382
44	BS14	259	2.244	1.451
99	BS14	259	2.244	1.451
101	BS13	91	0.910	0.588
186	BS12	165	1.521	0.983
193	BS11	46	0.507	0.328
272	BS7, 8, 9, 10, & 31B	4,045	25.396	16.419
80	BS6	187	1.695	1.096
86	BS5	83	0.841	0.544
89	BS4	332	2.791	1.804
262		748	5.681	3.673
20A	BS2 & BS3	649	5.015	3.242
298	BS1	61	0.646	0.417



LEGEND

-  EXISTING SEWER
-  SUBSYSTEM BOUNDARIES
-  HIGHWAYS
-  STREETS
-  BS-1 BEAL SLOUGH DRAINAGE SUBBASINS
-  FLOW PATTERN IN BASIN

City of Lincoln, NE
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**Beal Slough Drainage Basins
 October 2003**

B. Design Flows and Sewer Modeling

The City's standard wastewater flow generation equation that is used to estimate design flows is:

$$Q = \{0.01726 * (A^{0.8})\} + \{0.003 * A\}$$

Where: Q = Peak design flow in cfs

A = Total acres served by sewer

A review was conducted of previous reports and documentation relating to the study area including engineering analysis, inventory databases, and maps provided by the City. Based on the City's design flow curve and historical flow data, unit-hydrographs were created for each point of entry, which included both existing and ultimate flow conditions. The existing sewer was then modeled utilizing Hydroworks to perform system hydraulic analyses on the existing trunk sewer system. This modeling determined for each line segment the peak flows, percentage of capacity used, and preliminary relief sewer size. Listed below are the criteria selected for hydraulic design of the Beal Slough Relief Trunk Sewer:

- Minimum Velocity (Full Pipe) = 3 ft/s
- Maximum Velocity = 12 ft/s
- Manning Coefficient = 0.013
- Minimum Slope = Based on Minimum Velocity
- Existing Sewer Allowable Flow/Capacity Ratio = 1.0
- New Relief Sewer Design Flow/Capacity Ratio = 0.90
- Minimum Depth of Cover = 10 ft

Based on the criteria selected for hydraulic design, Table 2 was created indicating the future peak flow, existing capacity, new capacity, existing diameter, new or replacement diameter, manhole depth, length between each manhole, and the slope. Areas designated with an * represent portions of Phase I that will not replace the existing sewer and will operate as a parallel relief. The relief sewer invert shall be located one foot below the existing sewer invert.

Table 2 – Hydraulic Modeling Results

Manhole	Peak Flow, cfs	Existing Capacity, cfs	New Capacity, cfs	Existing Diameter, in	New or Replacement Diameter, in	MH depth, ft	Length, ft	Slope, ft/ft
BL_3	27.4	10.4	34.8	21	36	24.60	83	0.00434
BL_565	27.4	10.7	35.6	21	36	27.70	338	0.00453
BL_12	27.4	10.6	35.5	21	36	21.20	457	0.00451
BL_13	27.7	10.6	35.5	21	36	20.40	453	0.00450
BL_14	29.2	12.4	36.6	24	36	19.30	456	0.00300
BL_15	29.2	12.4	36.5	24	36	23.20	444	0.00300
BL_16	29.1	11.9	35.1	24	36	20.30	438	0.00276
BL_17	30.7	12.4	36.5	24	36	19.80	330	0.00300
BL_19	30.7	12.4	36.6	24	36	18.60	432	0.00301
BL_36	30.7	12.4	36.6	24	36	15.00	449	0.00301
BL_37	30.7	12.4	36.5	24	36	15.30	451	0.00299
BL_38	30.7	12.4	36.5	24	36	16.60	450	0.00300
BL_39	30.6	12.4	36.6	24	36	18.24	452	0.00301
BL_40	30.6	12.4	36.4	24	36	19.60	315	0.00298
BL_41	30.6	11.5	34.0	24	36	19.90	158	0.00260
BL_42	31.4	12.4	36.6	24	36	19.80	525	0.00301
BL_43	31.7	12.4	36.5	24	36	21.45	489	0.00299
BL_44	33.1	12.4	36.5	24	36	22.05	417	0.00300
BL_92	33.1	12.4	36.5	24	36	26.05	495	0.00299
BL_99	34.4	13.4	39.5	24	36	23.25	540	0.00350
BL_101	34.8	12.4	36.5	24	36	20.00	358	0.00299
BL_186	35.7	13.0	38.4	24	36	17.80	490	0.00331
BL_188	35.7	17.0	36.5	27	36	16.60	413	0.00300
BL_190	35.6	16.9	36.4	27	36	17.20	402	0.00299
BL_191	35.6	17.0	36.6	27	36	16.00	489	0.00301
BL_193	35.9	18.1	38.9	27	36	16.00	509	0.00340
BL_195	35.9	18.1	38.9	27	36	15.70	500	0.00340
BL_197	35.9	15.0	48.7	27	42	16.40	500	0.00234
BL_239	35.9	24.7	60.5	30	42	17.79	188	0.00362
BL_272	61.0	74.0	181.4	30	42	16.00	24	0.03250
BL_80	62.1	25.0	87.5	30	48	18.40	526	0.00371
BL_82	62.0	24.6	86.0	30	48	13.80	600	0.00358
BL_84	62.0	24.8	87.0	30	48	15.60	600	0.00367
BL_86	62.5	25.2	88.1	30	48	16.20	588	0.00376
BL_89	64.2	24.9	87.1	30	48	15.40	590	0.00368
BL_91	64.2	25.3	88.7	30	48	16.60	63	0.00381
BL_241	64.2	25.0	87.6	30	48	16.60	226	0.00372
BL_93	64.2	25.0	87.6	30	48	18.60	180	0.00372

Table 2 – Hydraulic Modeling Results (cont)

BL_95	45.9	*	46.1	*	42	18.77	171	0.00211
108	45.9	*	46.1	*	42	20.06	217	0.0021
107	45.9	*	46.1	*	42	17.40	595	0.0021
106	45.8	*	46.1	*	42	14.30	1349	0.0021
105	45.8	*	46.1	*	42	18.50	727	0.0021
104	45.8	*	46.1	*	42	13.49	795	0.0021
103	45.8	*	46.1	*	42	23.58	156	0.0021
102	45.7	*	46.1	*	42	28.04	1930	0.0021

Based on the hydraulic analysis conducted, the Beal Slough Relief Trunk Sewer-Phase I will have 5,940 linear feet of 42-inch diameter sewer from the Salt Valley Relief Trunk Sewer – Phase IV connection to the existing sewer at approximately 17th Street and 3,471 linear feet of 48-inch diameter sewer from 17th Street to 27th Street. Flow from the 48-inch sewer is divided into an existing 30-inch Beal Slough Sewer and the new 42-inch relief sewer with all dry weather flow to be conveyed through the relief sewer.

The Beal Slough Relief Trunk Sewer – Phase II will have 712 linear feet of 42-inch diameter sewer from 27th Street to 33rd Street and 10,982 linear feet of 36-inch diameter sewer from 33rd Street to 56th Street.

C. Sewer Slope, Capacity & Velocity

The sewer slope varies between different segments based on the requirements for connections to existing sewers and maintaining an elevation below the Beal Slough streambed in Phase I, as indicated in Table 2.

D. Pipe Design

1. Pipe Materials

The pipe materials for this project include pre-stressed concrete cylinder pipe (PCCP), reinforced concrete cylinder pipe (RCCP), reinforced concrete pipe (RCP), centrifugally cast fiberglass reinforced polymer mortar pipe (CCFRPMP), polyvinyl chloride (PVC), and vitrified clay pipe (VCP).

These pipe materials will be specified as listed below for the following sizes and installation methods.

<u>Pipe Diameter (inches)</u>	<u>Pipe Materials</u>
48" & smaller-trenched	PCCP, RCCP, RCP, CCFRPMP, PVC, VCP
48" & smaller -tunneled (two-pass)	PCCP, RCCP, RCP, CCFRPMP, PVC, VCP
48" & smaller -tunneled (direct jacked)	PCCP, RCCP, RCP, CCFRPMP, VCP

RCCP and PCCP will be furnished with rubber and steel joints and RCP will be furnished with rubber and concrete joints. RCCP, PCCP, and RCP will be furnished with an internal plastic liner.

2. Embedment, Backfill, and Spoil

a. Pipe Embedment

Pipe embedment will be as shown on Figure 5. The pipe will be designed for an additional five feet of cover throughout the project area to allow for a future tie-back levee and other future construction.

b. Trench Backfill

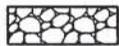
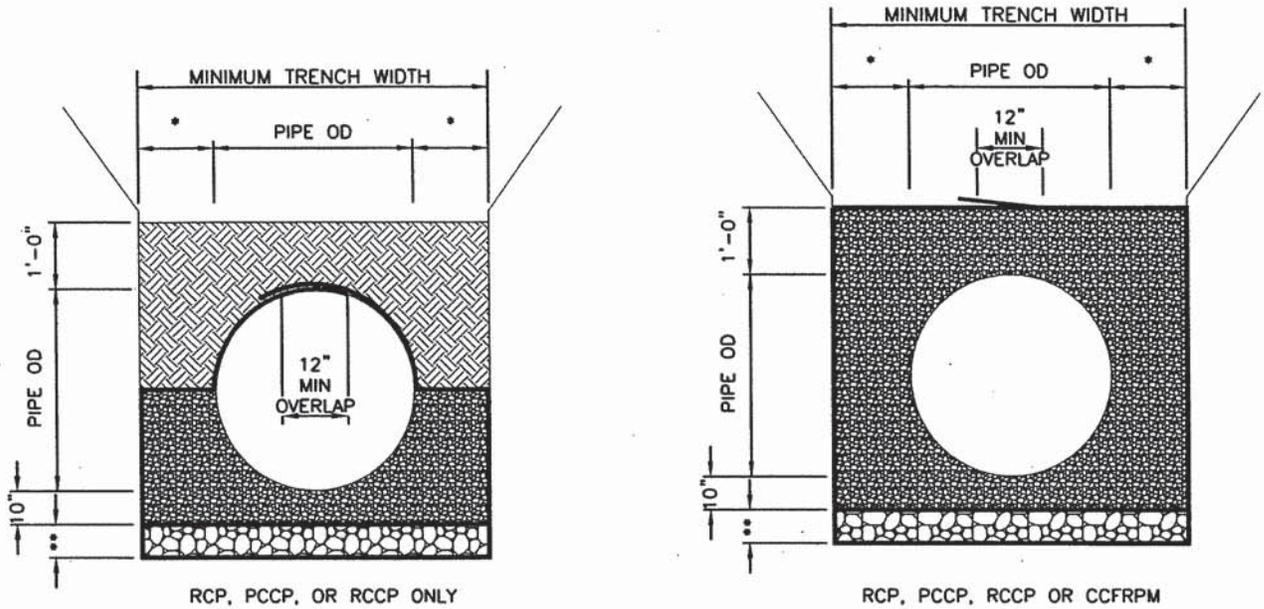
Backfilling requirements will be similar to those for Salt Valley Trunk Sewer Phase IIA & IIIB and Phase IV. Fill under grass areas will be compacted to a minimum of 90%-92% density and fills under roads and streets will be compacted to a minimum of 95% density of standard proctor.

c. Spoil Materials

Excess spoil will be disposed of by the Contractor. No spoil is to be placed on the LES easement while paralleling or crossing the easement during construction.

*=MIN. $\frac{\text{PIPE O.D.}}{2}$ FOR <60" DIAMETER PIPE

**=MIN. 6" ALL OTHER PIPE DIAMETERS



TYPE B AGGREGATE—CRUSHED ROCK FOUNDATION MATERIAL. INSTALL ONLY WITH ENGINEER'S AUTHORIZATION. PLACE AND COMPACT AS REQUIRED TO STABILIZE TRENCH BOTTOM.



TYPE A AGGREGATE—GRANULAR EMBEDMENT MATERIAL. INSTALL AS DESCRIBED BELOW: PIPE BED: PLACE IN MAXIMUM 4" LOOSE LIFTS AND COMPACT TO MINIMUM 70% RELATIVE DENSITY PER ASTM D4253. LOOSELY PLACE THE REMAINING 2" OF BEDDING TO PROVIDE UNIFORM SUPPORT FOR THE PIPE. PIPE HAUNCHING AND EMBEDMENT: PLACE IN MAXIMUM 6" LOOSE LIFTS AND COMPACT TO MINIMUM 70% RELATIVE DENSITY PER ASTM D4253.



SELECT BACKFILL MATERIAL—SHALL BE SELECT NATIVE MATERIAL FREE FROM ROOTS, ROCKS, OR OTHER DELETERIOUS MATERIALS. PLACE IN MAXIMUM 6" LOOSE LIFTS AND COMPACT TO MINIMUM OF 95% OF MAXIMUM DRY DENSITY OF THE MATERIAL AS DETERMINED BY ASTM D698.



CONTECH "C 60NW" NONWOVEN GEOTEXTILE FABRIC—12" MINIMUM LAP AT JOINTS AND EDGES. PROVIDE FOR GRANULAR EMBEDMENT AND CRUSHED ROCK FOUNDATION FOR ALL ϕ SEWER PIPE AND STRUCTURES AS REQUIRED.

SEWER PIPE FOUNDATION & EMBEDMENT FOR SANITARY SEWERS

NOT TO SCALE

PROJECT: 134056.0202
 DRAWN BY:
 DATE: 9/10/03

PIPE FOUNDATION
 AND EMBEDMENT


 OLSSON ASSOCIATES
 ENGINEERS PLANNERS SCIENTISTS ARCHITECTS


 BLACK & VEATCH
 CORPORATION

FIGURE
 5

E. Manholes

Manholes shall be placed at the intersections of all sanitary sewer lines, changes in horizontal or vertical alignment, at pipe diameter or material changes, and at the end of any terminating line. Typical manhole spacing for the existing Beal Slough sewer is 500-600 feet. Manhole spacing for the straight portions of the new relief sewer shall be approximately 800 feet or as appropriate for site specific conditions. City of Lincoln standard manholes will be used in all locations. An internal plastic liner will be provided for concrete manholes.

F. Connections to Existing and Future Sewer Facilities

Phase I of the relief trunk sewer shall divert flow by connecting to the existing 24-inch Salt Valley Trunk Sewer south of the existing siphon across Beal Slough and the 16-inch sewer along 14th Street. From 17th Street to 27th Street, the existing Beal Slough sewer shall be abandoned; therefore, all existing connections shall be relocated to the 48-inch replacement sewer. These relocations associated with Phase I include the following sewers:

- 12-inch sewer (VCP) near 20th Street
- 8-inch sewer (VCP) at Southwood Blvd.
- 18-inch sewer (VCP) at 27th Street
- 18-inch sewer (VCP) at 27th Street

Phase I of the relief trunk sewer shall end on the east side of 27th Street with provisions for future connection to the 42-inch diameter sewer to be constructed during Phase II.

Phase II of the relief trunk sewer shall replace the existing sewer in its entirety; therefore, all connections to sewers along the existing sewer shall be modified to convey flow into the relief sewer. The following sewers shall be modified to provide a connection into the replacement sewer.

- 8-inch sewer (VCP) near 30th Street
- 10-inch VCP that parallels the existing Beal Slough sewer from
- 8-inch sewer (VCP) near 35th Street
- 10-inch sewer (VCP) near 36th Street
- 12-inch sewer (VCP) near 38th Street

- 8-inch sewer (VCP) near 39th Street
- 10-inch sewer (VCP) at 40th Street
- 8-inch sewer (VCP) near 48th Street
- 12-inch sewer (CIP) near 48th Street
- 10-inch sewer (VCP) near 52nd Street
- 8-inch sewer (VCP) near 53rd Street
- 8-inch sewer (VCP) at 56th Street
- 18-inch sewer (VCP) at 56th Street
- 24-inch sewer (PVC) at 56th Street

An 8-inch sewer near 81-Lumber was indicated by LWWS to require replacement. This replacement will be evaluated during final design.

G. Special Construction

1. Tunneling

Tunneling options will be similar to those allowed on Salt Valley Trunk Sewer Phase IIB & IIIA and Phase IV. Direct pipe jacking will be allowed in conjunction with the use of RCCP, RCP, CCFRPMP, or VCP. Two-pass tunneling will be allowed using either tunnel liner plate or steel casing pipe with PCCP, RCCP, RCP, CCFRPMP, PVC, or VCP as the carrier pipe within the primary liner. Crossing of the railroad tracks north of the LES substation at 20th Street will require tunneling or open-cut excavation with removal and replacement of the tracks. LES will allow either option; therefore, the drawings indicate the crossing as an open-cut excavation. Tunneling will be required for the following locations:

- a. Phase I
 - BNSF railroad crossing at 6th Street
 - BNSF railroad crossing southwest of the State Penitentiary Facilities
 - 14th Street
 - 115 KVA LES transmission main crossing near 17th Street
 - Southwood Blvd.
 - Beal Slough/BNSF railroad crossing/27th Street

- b. Phase II
 - Highway 2 and 40th Street
 - 48th Street

2. Diversion Structure

A diversion structure shall be constructed in the vicinity of station 57+80, where flow will be diverted from the 48-inch relief sewer into either the 42-inch relief sewer extending to the south or the existing 30-inch sewer extending to the northwest. The invert of the new 48-inch sewer shall be one foot below the invert of the existing 30-inch sewer. The new 42-inch sewer shall be at the same elevation as the invert of the 48-inch sewer to allow dry-weather flow to be conveyed through the relief sewer. The structure shall be constructed of concrete with an internal plastic liner to prevent corrosion damage.

3. Crossing of Beal Slough

It is intended to cross Beal Slough east of the BNSF railroad bridge, south of the State Penitentiary. The 42-inch sewer crossing will have an invert elevation of 1140.8 feet. Preliminary survey of the streambed at the crossing indicated an elevation of 1147.0 feet, therefore, a clearance of three feet between the crown of the sewer and the streambed would be obtained. A grade check structure shall be constructed around and on top of the sewer to prevent future degradation of the streambed near the sewer.

A second grade check constructed of rock shall be located approximately 100 feet west of the BNSF railroad bridge to prevent streambed degradation from encroaching upon the sewer from downstream and provide additional protection to the existing bridges and sewer.

The streambed elevation near the proposed grade check locations has degraded approximately five feet from the elevations provided in the Beal Slough Master Plan. Therefore, the elevations that the grade checks shall be constructed must to be coordinated during final design.

Additional crossing of the Beal Slough occur west of 40th Street and near 52nd Street. Each sewer crossing will have encasement and be located beneath the streambed. The crossing west of 40th Street will be coordinated with the study conducted by Intuition and Logic.

Main channel improvements have been considered west of 27th Street for 2004. These improvements will be coordinated during final design.

A drainage ditch near Sta 68+00 may require a grade check to prevent head cutting as it feeds into Beal Slough. This grade check will be further investigated during final design.

4. Fiber Optic Conduit

A 4-inch fiber optic PVC conduit shall be installed as a portion of this project. The conduit shall be located within the permanent easement or tight-of-way approximately five feet from the edge of the right-of-way or permanent easement at a minimum of 3'-6" below grade to top of pipe.

LES has requested a second telecommunications conduit to be installed from the connection to Salt Valley-Phase IV to the substation near 20th Street. This will be resolved during final design.

5. Security Fence

A temporary security fence will be provided at Budget Self Storage during construction along the northwest corner of the property.

6. 27th Street Safety Project

A safety project by the City of Lincoln-PWU will be constructed at 27th Street in 2004. This project will be coordinated with the sewer construction.

H. Abandoning the Existing Beal Slough Sewer

The existing Beal Slough shall be abandoned in-place from approximately 17th Street east to 56th Street. Abandonment of the existing sewer shall be completed in accordance with the City of Lincoln Engineering Services Division Standard Specifications Section 22-A. Where called for on the plans, the Contractor shall plug and abandon existing sewer pipes, and either completely remove existing manholes or fill and abandon existing manholes in place. Manholes to be removed shall be totally removed from the existing location and disposed of. The top eight feet of manholes to be filled and abandoned shall be removed, and approved material shall be compacted in the abandoned manhole to the densities required. The existing sewer shall be backfilled with flowable fill.

I. Restoration**1. Seeding**

Areas disturbed by construction activities shall be reseeded in accordance with the City of Lincoln standards or restored as negotiated by City Real Estate when obtaining temporary construction easements. Seeding associated with Parks and Recreation property is indicated below in item 3.

2. Beal Slough

Beal Slough shall be restored in accordance with the permit required for completing the work. A stream restoration permit will need to be obtained from the U.S. Corps of Engineers if a grade check structure is constructed in Beal Slough. A utility crossing permit will be required for open trench excavating of Beal Slough

3. Park Areas

Park areas shall be restored to their original condition in accordance with the Lincoln Parks and Recreation Department. Parks and Recreation will re-seed all park areas damaged by construction operations to ensure proper seeding standards and installation. Tree replacement will be completed on a 1 to 1 basis with 1-1/2 inch diameter trees. Parks and Recreation will conduct the tree replacement work with City forces.

- The playground equipment in Peterson Park will be removed by the Parks and Recreation Department prior to excavation for the sewer. The Parks and Recreation Department will provide new equipment to be installed by the Parks and Recreation Department. Payment for the new equipment is being negotiated by the City of Lincoln. Final grading of the playground area shall be approved by the Parks and Recreation Department.
- The parking lot in Peterson Park will be disrupted during construction and the Parks and Recreation Department has requested modifications for replacement of the parking lot to include a larger area. The existing lot has 23 spaces, and a replacement lot will hold 50 spaces. The replacement lot will have a concrete curb perimeter and crushed rock. When the parking lot is disturbed, temporary parking shall be provided for number of the vehicles indicated in Table 2.

Table 3 – Peterson Park Usage Requirements			
Duration	Event	Time	Vehicles
April – May	High School Baseball	6:30-9:30 P.M.	25
March 15 – May 15	High School Soccer	3:30-6:30 P.M.	25
June – August	Youth Baseball	9:00 A.M. – 5:00 P.M.	20
June – August	Youth Baseball	6:00 – 8:30 P.M.	50
August – November	Youth Football	5:00 – 9:00 P.M.	30
Year-round use of tennis courts			

- The hiking/biking trail shall be restored to its original condition in accordance with the Lincoln Parks and Recreation Department.
- The pedestrian bridge located near 52nd Street may require replacement. The potential replacement will be verified with FEMA modeling for improvements above the 100-year flood event. Alternatives for replacement include modifying the sewer alignment, tunneling the existing bridge, or replacement of the bridge with a similar structure. This item will be further evaluated during final

design and will be coordinated with the Lincoln Parks and Recreation Department.

APPENDIX "A"

Environmental Assessment Data Memorandum

TECHNICAL MEMORANDUM

Lincoln Wastewater System
Beal Slough Relief Trunk Sewer Phases I & II
EDR Area Study Report

B&V Project: 134056.0201
B&V File: B-1.1
June 23, 2003

An Environmental Data Registry (EDR) Area Study Report was obtained for the Beal Slough Relief Trunk Sewer Phases I & II Project to investigate the potential for hazardous substances along the preliminary alignments. This memorandum summarizes the findings of that report relative to the Beal Slough Sewer. The EDR is a comprehensive, authoritative source of reference information about the definition, source, and uses of environmental data. The EDR is a part of the centralized systems of registries, which provides access to the Environmental Protection Agency's (EPA) core registry systems. The EDR catalogs the Agency's major data collections and helps locate environmental information of interest.

The following is a listing of registries and databases that are included in the EDR report:

Federal ASTM Standard

- CERCLIS: Comprehensive Environmental Response, Compensation and Liability Information System
- CORRACTS: List of handlers with RCRA Corrective Action Activity
- RCRIS: Resource Conservation and Recovery Act

State ASTM Standard

- LUST: Leaking Underground Storage Tank Incident Reports
- UST: Underground Storage Tank
- SWRCY: Department of Environmental Protection's Recycling Facilities

Federal ASTM Supplemental

- FINDS: Facility Index System
- TRIS: Toxic Chemical Release Inventory System
- SSTS: Register Pesticide-Producing Establishments List
- FTTS: Administrative Cases and Pesticide Enforcement Actions

State or Local ASTM Supplemental

- SPILLS: Nebraska Surface Spill List

Other Databases

- Former Manufactured Gas (Coal Gas) Sites

The EDR report provided a listing of potential sites along the Beal Slough sewer alignments from the registries and databases searched as indicated above. From the listing, each site was evaluated for its proximity to the potential alignments and a list of high priority sites was created.

TECHNICAL MEMORANDUM

Lincoln Wastewater System
 Beal Slough Relief Trunk Sewer Phases I & II
 EDR Area Study Report

B&V Project: 134056.0201
 B&V File: B-1.1
 June 23, 2003

The high priority EDR sites in close proximity to the Beal Slough Sewer are shown in the following table and on Figure 1. This list and the figure do not include all sites indicated in the EDR report, only those which present the highest priority.

EDR Sites of High Priority and in Close Proximity to the Beal Slough Sewer Alignments			
ID Number	Site Name	Address	Database
38	International Development and Licensing	3501 South 6th Street	SSTS
39	Waverly Coop	940 Calvert	LUST
41	13th and Stockwell	13th and Stockwell St	CERCLIS
43	NDOR	1500 NE Hwy 2	SPILLS/LUST
44	Burger King	1400 Pioneers Blvd	LUST
44	Fleming Foods of Nebraska	1601 Pioneers Blvd	SPILLS/LUST
46	Buggy Bath Car Wash	3301 Pioneer Blvd	LUST
46	Getty Gas Station	33rd St and Pioneers Blvd	LUST
49	Weaver Potato Chip Company	1600 Center Park Rd	LUST
49	Pegler Sysco Co	1700 Center Park Rd	LUST
49	Pegler Sysco Food Services	1700 Center Park Rd	LUST
50	Husker Tire	1421 Center Park Rd	LUST
52	Cushman Building	4700 South 19th St	LUST
52	Fleet Maintenance	1900 Center Park Road	LUST
55	Fitch Trucking	40th St and Hwy 2	SPILLS
57	Sesco	5611 South 50th St.	LUST
57	Century Towing	4901 Rentworth	SPILLS
59	Earl May Feed	56th St and Hwy 2	SPILLS
59	Unknown	56th St and Hwy 2	SPILLS
59	-	56th St and Hwy 2	SPILLS
59	Earp Meat Company	56th St and Hwy 2	SPILLS
61	Rexs 66	5601 Old Cheney	LUST
61	Manhole – 56th and Old Cheney	56th St and Old Cheney Rd	LUST
61	61 Orph Tank @ 56th St and Hwy 2	5510 Old Cheney	LUST

TECHNICAL MEMORANDUM

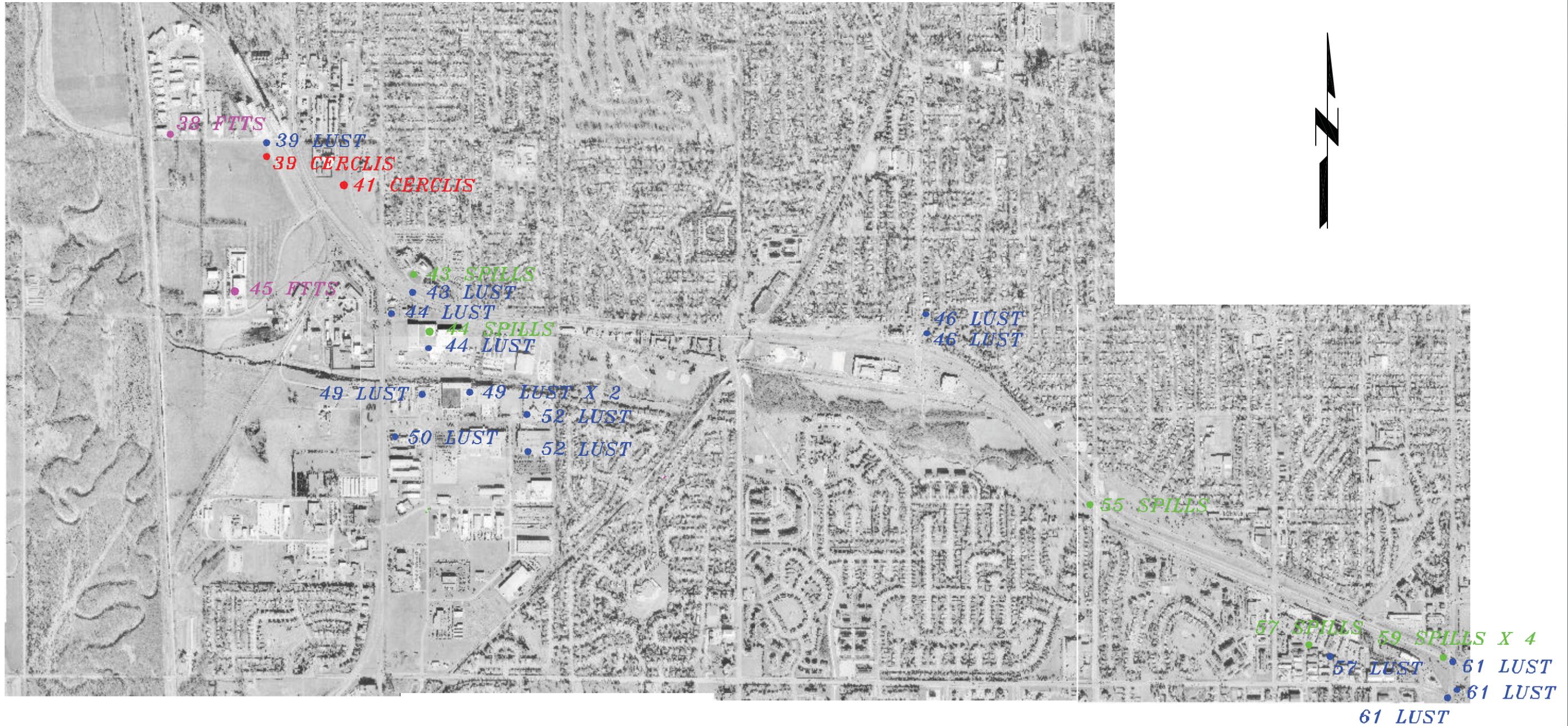
Lincoln Wastewater System
Beal Slough Relief Trunk Sewer Phases I & II
EDR Area Study Report

B&V Project: 134056.0201
B&V File: B-1.1
June 23, 2003

Findings:

The findings of the EDR report indicate that there are four areas of concern for the alignment of the sewers as follows:

- 9th Street and Highway 2. This section has been listed as containing carbon tetrachloride and chloroform in groundwater. No future remedial action is currently planned for the site. Alignments of the pipeline will not proceed along Calvert to 9th Street and Highway 2, thus avoiding this location.
- South side of Beal Slough from 14th Street to 19th Street. This section has four leaking underground storage tanks located on properties owned by Weaver's Potato Chips Company, Pegler Sysco, and Fleet Maintenance. No remedial actions are currently planned for these sites and the state trust fund for remediation of leaking underground storage tanks has been exhausted. An alignment along the south side of Beal Slough will have to conduct further studies to determine the exact location of the storage tanks and the progression of contaminants in the soil and groundwater. Geotechnical exploration along this alignment should include sampling for volatile organics, semi-volatile organics, and RCRIA metals.
- 40th Street and Highway 2. A motor vehicle spill occurred at this intersection involving Fitch Trucking. Information pertaining to this spill should be obtained from the EDR and from the Nebraska Department of Environmental Quality to determine the contaminants and volume of the spill. Alignments for all three alternatives are located in this area and may require remediation activities. Geotechnical exploration along these alignments should include sampling for volatile organics, semi-volatile organics, and RCRIA metals.
- 56th Street and Highway 2. Four motor vehicle spills have occurred at this intersection as indicated in the attached table. Also, three leaking underground storage tanks are located within one block of the intersection. A project was recently completed for the installation of a 24 inch sewer on the west side of 56th Street at Highway 2. This project should be examined to determine if any contaminants were encountered and if remediation was required. Alignments for all three alternatives are located in this area and may require remediation activities. Geotechnical exploration along these alignments should include sampling for volatile organics, semi-volatile organics, and RCRIA metals.



Legend

High Priority Listed Sites

- OPEN LUST (Leaking Underground Storage Tank)
- SPILLS (Surface Spill)
- FTTS (Administrative Cases and Pesticide Enforcement Actions)
- CERCLIS (Potentially Hazardous Waste Sites)

Number Indicates Reference to Site Listed in EDR Area Study Report

City of Lincoln, NE
 Beal Slough Relief Trunk Sewer
 Phases I & II

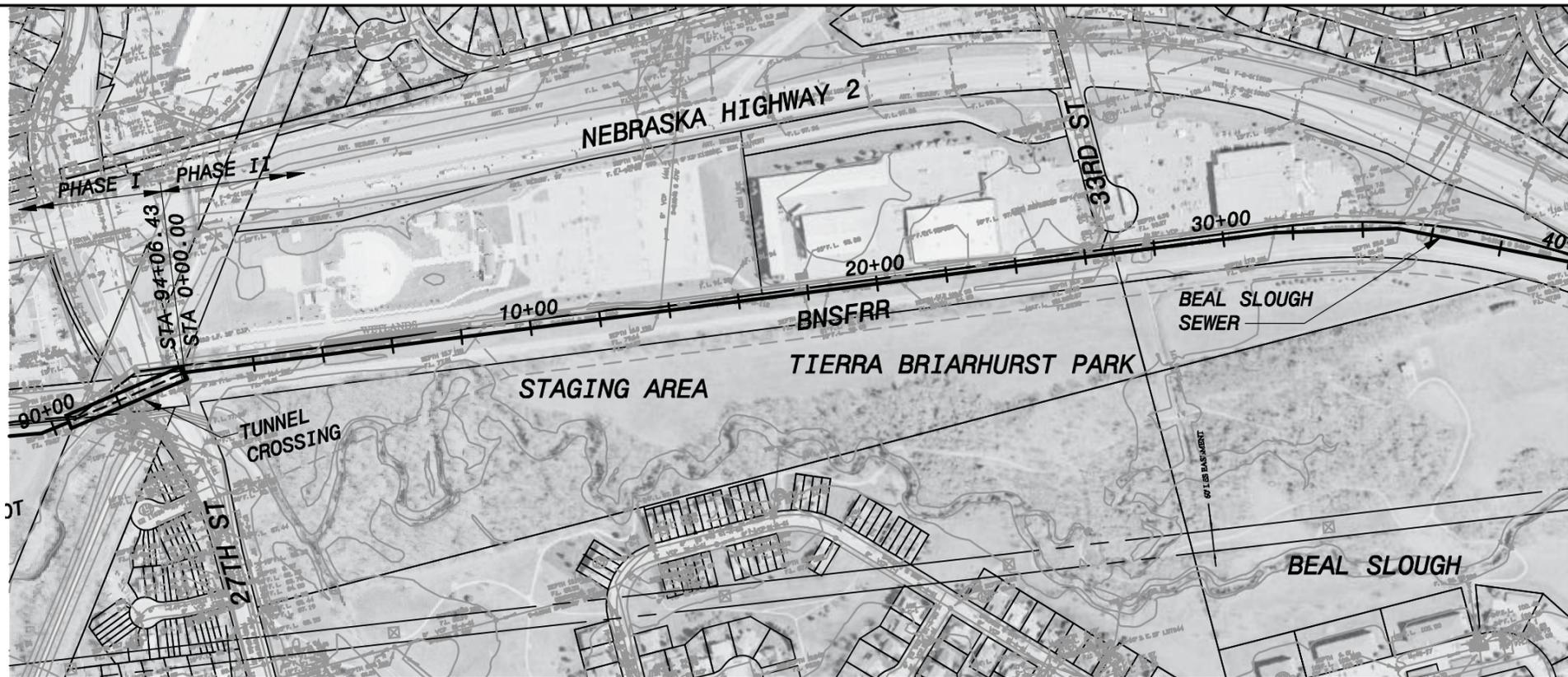
EDR Area Study Report Map
 2003



Figure 1



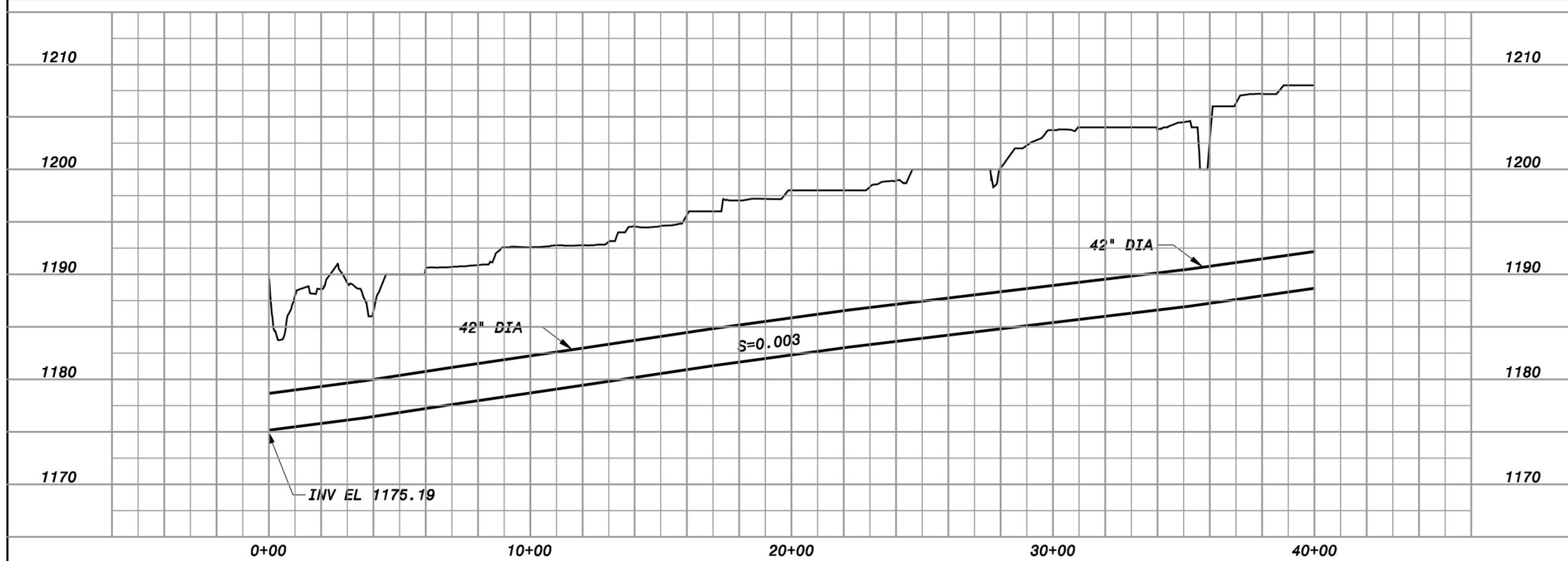
APPENDIX "B"
Preliminary Plan and Profile Drawings



- NOTES:
1. REFER TO ALIGNMENT STUDY DRAWINGS FOR ADDITIONAL DETAIL OF THE PLAN VIEWS.
 2. EXISTING BEAL SLOUGH TO BE ABANDONED FROM STA 0+00.00 TO STA 116+94.32.
 3. MANHOLE DROPS ARE INCLUDED IN THE AVERAGE SLOPES.



HORIZ: 1" = 400'
 VERT: 1" = 10'



NO.	BY	CHK	APP

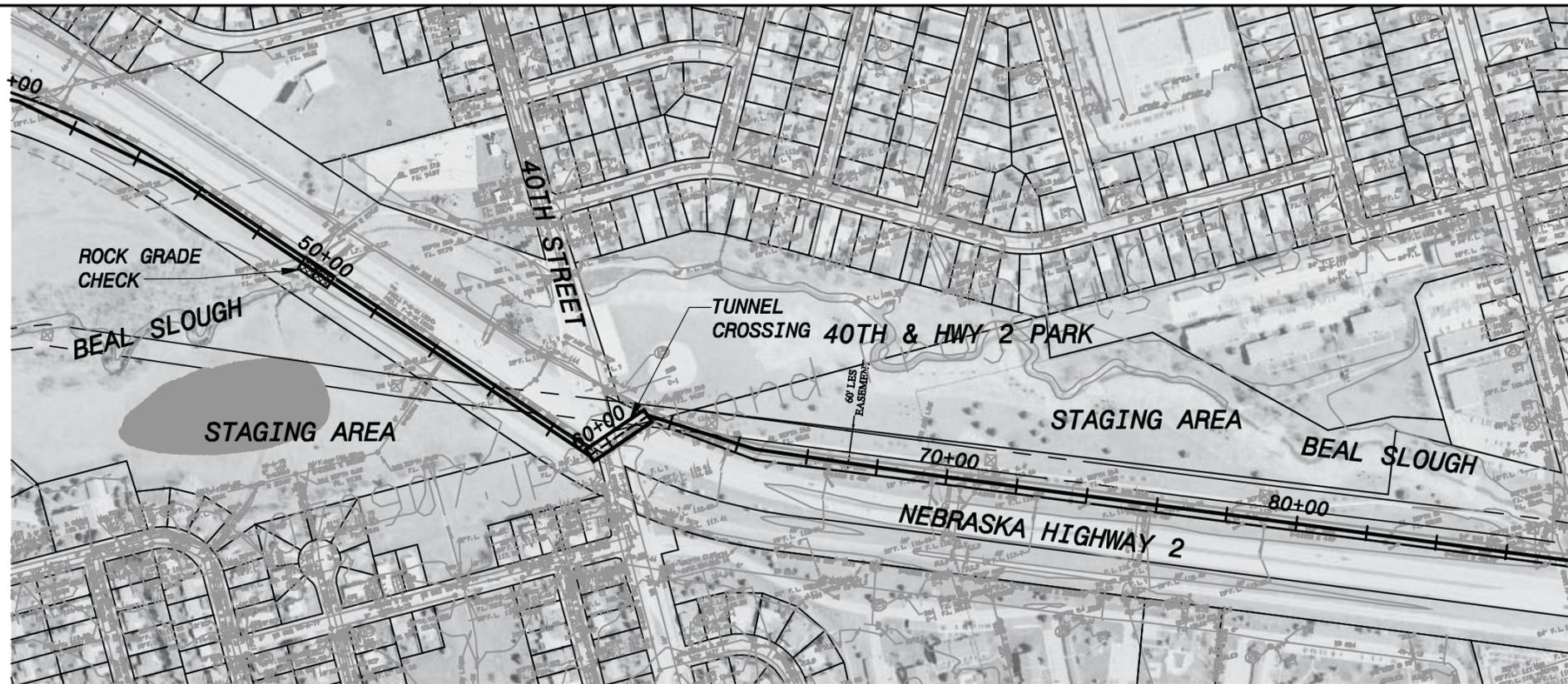


BLACK & VEATCH
 Corporation
 Kansas City, Missouri

LINCOLN WASTEWATER SYSTEM
BEAL SLOUGH RELIEF TRUNK SEWER
PHASE II

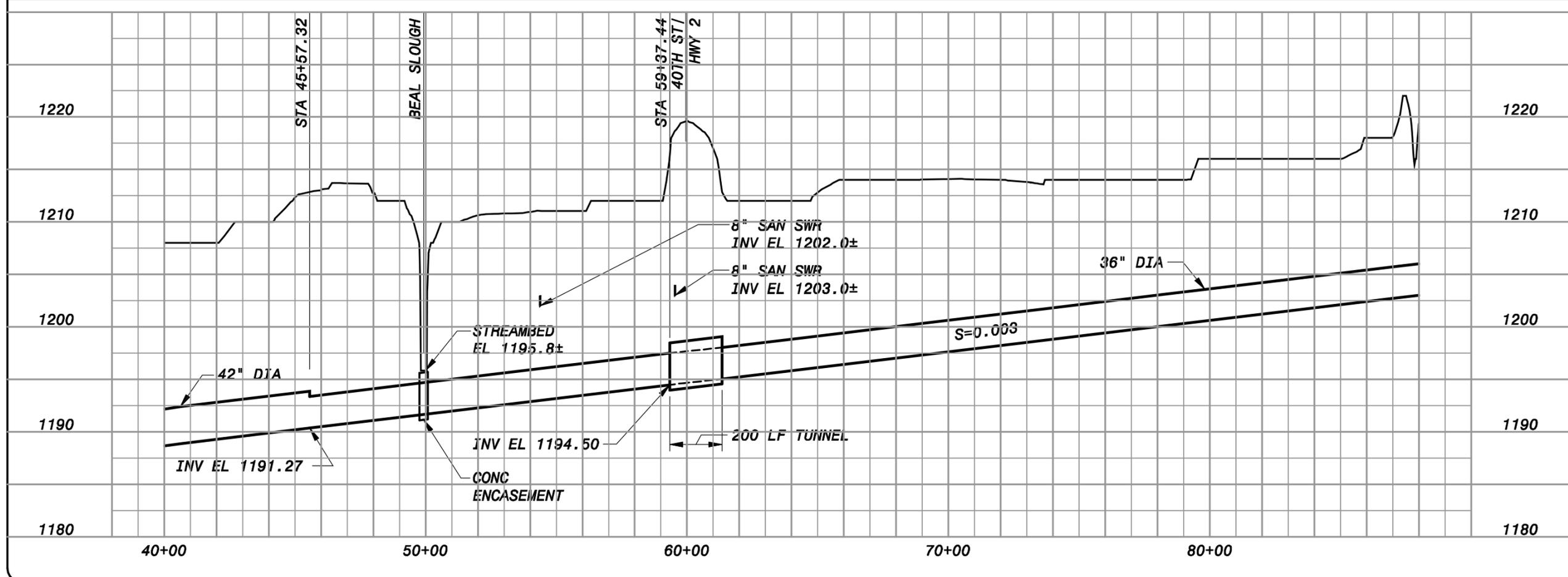
DESIGNED:
 DETAILED:
 CHECKED:
 APPROVED:
 DATE:

PROJECT NO.
134056



- NOTES:**
1. REFER TO ALIGNMENT STUDY DRAWINGS FOR ADDITIONAL DETAIL OF THE PLAN VIEWS.
 2. EXISTING BEAL SLOUGH TO BE ABANDONED FROM STA 0+10.00 TO STA 116+94.32.
 3. MANHOLE DROPS ARE INCLUDED IN THE AVERAGE SLOPES.

HORIZ: 1" = 400'
 VERT: 1" = 10'



NO.	BY	CHK	APP



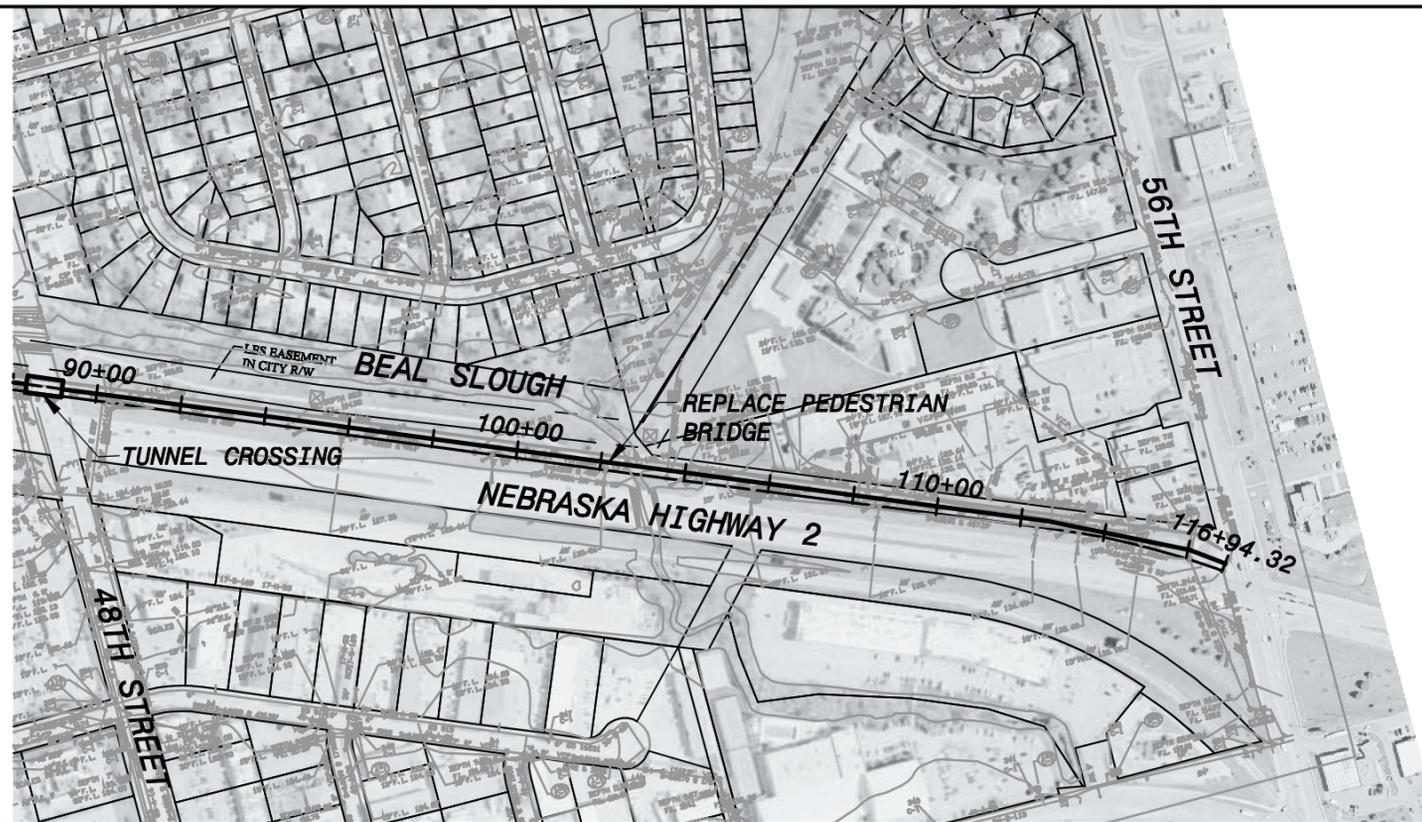
LINCOLN WASTEWATER SYSTEM
BEAL SLOUGH RELIEF TRUNK SEWER
PHASE II

DESIGNED:
 DETAILED:
 CHECKED:
 APPROVED:
 DATE:

PROJECT NO.
134056

SHEET
 2 OF 3

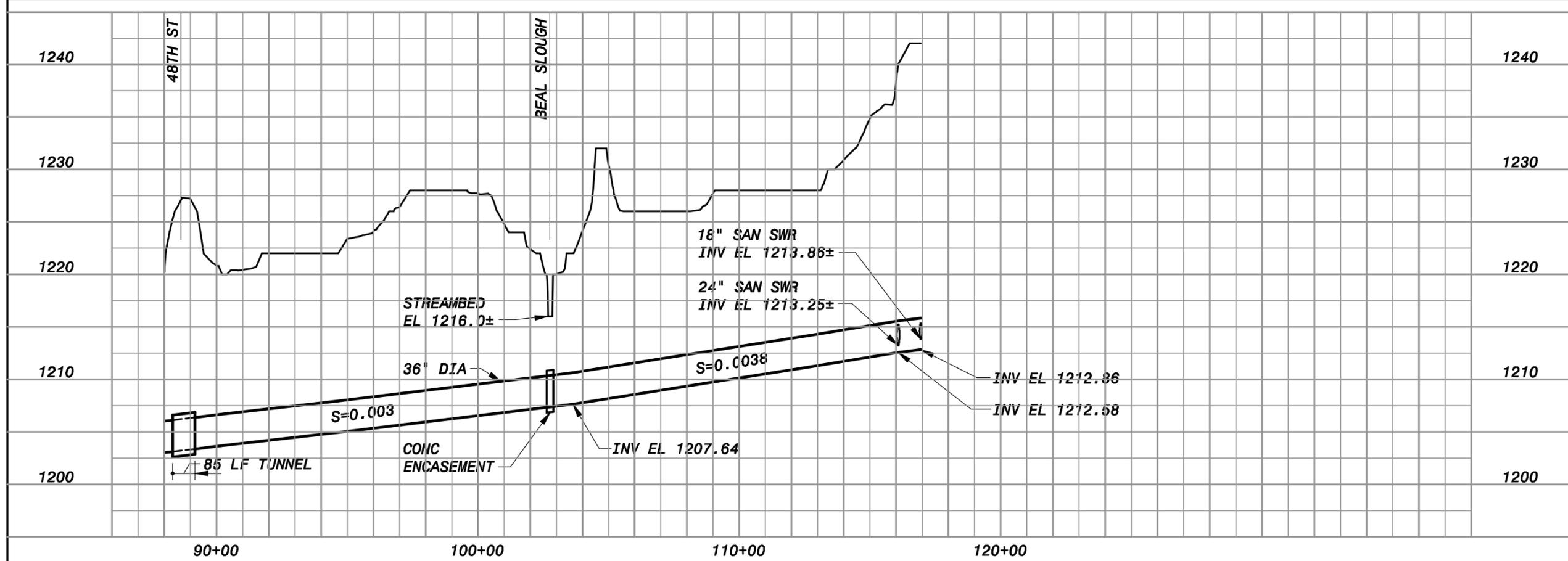
FB5000
 B5000



- NOTES:**
1. REFER TO ALIGNMENT STUDY DRAWINGS FOR ADDITIONAL DETAIL OF THE PLAN VIEWS.
 2. EXISTING BEAL SLOUGH TO BE ABANDONED FROM STA 0+10.00 TO STA 116+94.32.
 3. MANHOLE DROPS ARE INCLUDED IN THE AVERAGE SLOPES.



HORIZ: 1" = 400'
VERT: 1" = 10'



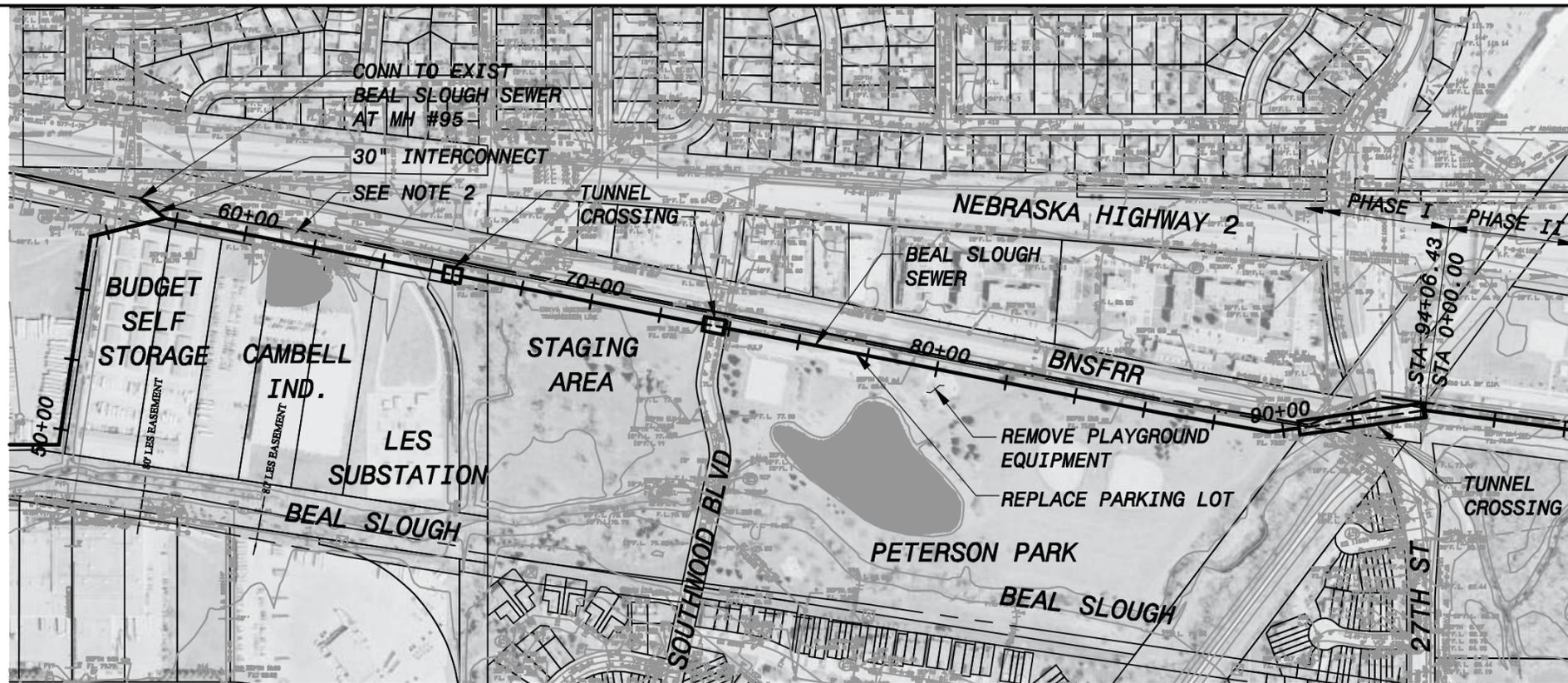
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LINCOLN WASTEWATER SYSTEM
BEAL SLOUGH RELIEF TRUNK SEWER
PHASE II

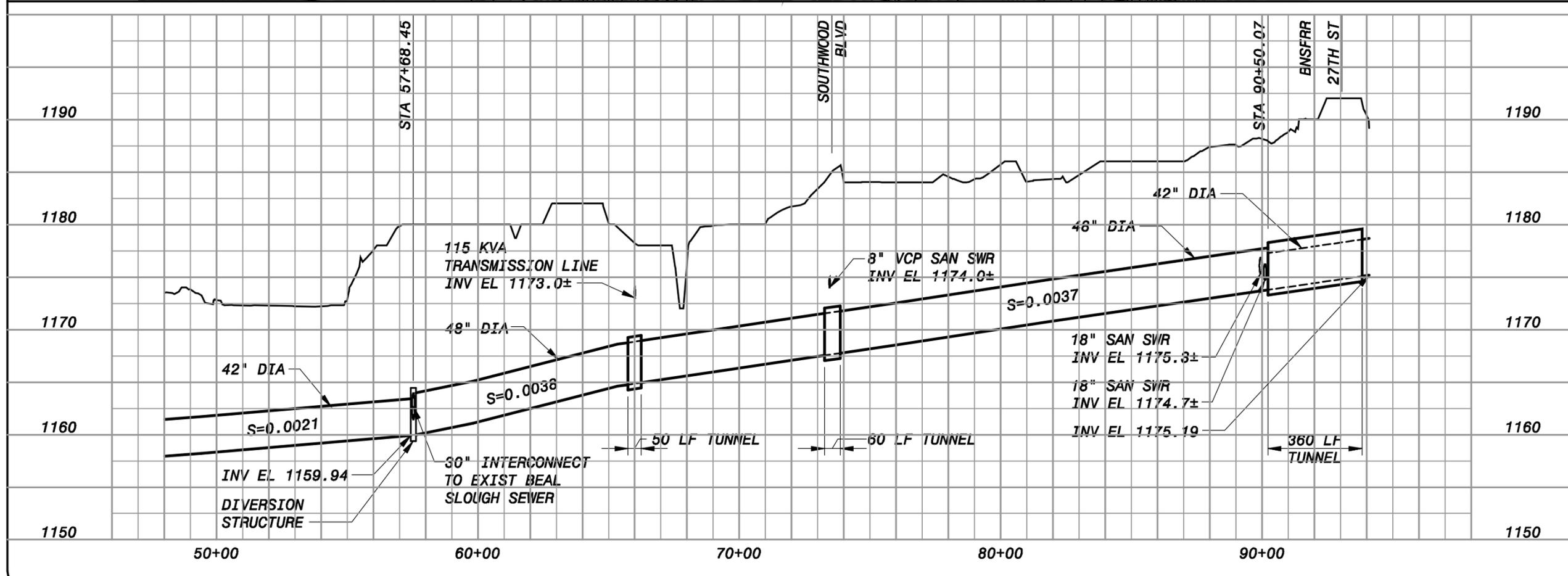
DESIGNED:
DETAILED:
CHECKED:
APPROVED:
DATE:

PROJECT NO.
134056



- NOTES:**
1. REFER TO ALIGNMENT STUDY DRAWINGS FOR ADDITIONAL DETAIL OF THE PLAN VIEWS.
 2. EXISTING BEAL SLOUGH TO BE ABANDONED FROM STA 59+80 TO STA 94+06.43
 3. MANHOLE DROPS ARE INCLUDED IN THE AVERAGE SLOPES.


 HORIZ: 1" = 400'
 VERT: 1" = 10'



NO.	BY	CHK	APP



LINCOLN WASTEWATER SYSTEM
BEAL SLOUGH RELIEF TRUNK SEWER
PHASE I

DESIGNED: _____
 CHECKED: _____
 APPROVED: _____
 DATE: _____

PROJECT NO.
134506

SHEET
 2 OF 2

FB5000
 B5000

APPENDIX "C"

Opinion of Probable Project Cost

BLACK & VEATCH

Lincoln, Nebraska
 Lincoln Wastewater System
 Beal Slough Relief Trunk Sewer Phases I & II
 Opinion of Probable Project Cost
 October 30, 2003

Alignment No. 2 - Phase I

<u>Item Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u> \$	<u>Total Cost</u> \$
GENERAL REQUIREMENTS				
Mobilization		Lump Sum	\$63,000	\$63,000
Supervision		Lump Sum	\$196,800	\$196,800
Temporary facilities		Lump Sum	\$47,200	\$47,200
Temporary utilities		Lump Sum	\$31,500	\$31,500
Equipment rental & misc.		Lump Sum	\$15,700	\$15,700
Total - General Requirements				\$354,000
DESCRIPTION				
Sewer Pipe in Place Excluding Manholes and Dewatering	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total Cost</u>
48" High Strength Gravity Sewer Pipe	3,471	LF	\$264	\$916,000
42" High Strength Gravity Sewer Pipe	5,940	LF	\$231	\$1,372,000
Subtotal				\$2,288,000
Grade Check				
Structure	1	LS	\$100,000	\$100,000
Rock Grade Check	2	EA	\$50,000	\$100,000
Subtotal				\$200,000
Tunnel Installation				
BNSF Railroad Line				
61" Tunnel	110	LF	\$976	\$107,000
BNSF Railroad Line				
61" Tunnel	105	LF	\$976	\$102,000
14th Street				
61" Tunnel	110	LF	\$915	\$101,000
115 KVA LES Transmission Main				
70" Tunnel	50	LF	\$1,050	\$53,000
Southwood Street				
70" Tunnel	60	LF	\$1,050	\$63,000
Beal Slough/BNSFRR/27th Street				
70" Tunnel	380	LF	\$1,120	\$426,000
Subtotal				\$852,000
Manholes				
Standard Manhole 4' Dia., 8' Deep or Less	19	EA	\$2,000	\$38,000
Standard and Drop Manhole Additional Depth	207	LF	\$250	\$52,000
Subtotal				\$90,000
Dewatering				
6 Foot Average Dewatering Depth	9,411	LF	\$25	\$235,000
Subtotal				\$235,000
Street Repairs				
Replace Asphalt Pavement	2,467	SY	\$45	\$111,000
Saw Cut, Remove, and Replace 8" Concrete	640	SY	\$65	\$42,000
Subtotal				\$153,000

BLACK & VEATCH

Lincoln, Nebraska
Lincoln Wastewater System
Beal Slough Relief Trunk Sewer Phases I & II
Opinion of Probable Project Cost
October 30, 2003

Alignment No. 2 - Phase I

<u>Item Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u> \$	<u>Total Cost</u> \$
Utility Relocation				
Miscellaneous Repairs and Relocations	1	LS	\$20,000	\$20,000
Subtotal				\$20,000
Miscellaneous				
Railroad Insurance and Flagging	30	Days	\$500	\$15,000
Seeding	41,827	SY	\$0.40	\$17,000
Fiber Optic Conduit	9,411	LF	\$7.00	\$66,000
Subtotal				\$98,000
Construction Cost Subtotal				\$4,290,000
Contingencies			15%	\$644,000
TOTAL CONSTRUCTION COST				\$4,934,000
ADDITIONAL PROJECT COSTS				
Right-of-Way Costs				
Permanent Easement	156,000	SF	\$1.00	\$156,000
Temporary Construction Easement	364,000	SF	\$0.10	\$36,000
Subtotal				\$192,000
Engineering, Legal, and Administrative Costs			20%	\$1,025,000
TOTAL PROJECT COST				\$6,151,000

BLACK & VEATCH

Lincoln, Nebraska
 Lincoln Wastewater System
 Beal Slough Relief Trunk Sewer Phases I & II
 Opinion of Probable Project Cost
 October 30, 2003

Alignment No. 2 - Phase II

<u>Item Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u> \$	<u>Total Cost</u> \$
GENERAL REQUIREMENTS				
Mobilization		Lump Sum	\$51,300	\$51,300
Supervision		Lump Sum	\$160,400	\$160,400
Temporary facilities		Lump Sum	\$38,500	\$38,500
Temporary utilities		Lump Sum	\$25,700	\$25,700
Equipment rental & misc.		Lump Sum	\$12,800	\$12,800
Total - General Requirements				\$289,000

<u>DESCRIPTION</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total Cost</u>
Sewer Pipe in Place Excluding Manholes and Dewatering				
42" High Strength Gravity Sewer Pipe	712	LF	\$231	\$164,000
36" High Strength Gravity Sewer Pipe	10,982	LF	\$198	\$2,174,000
Subtotal				\$2,338,000
Tunnel Installation				
Highway 2/40th Street				
49" Tunnel	205	LF	\$735	\$151,000
48th Street				
49" Tunnel	85	LF	\$735	\$62,000
Subtotal				\$213,000
Manholes				
Standard Manhole 4' Dia., 8' Deep or Less	23	EA	\$2,000	\$47,000
Standard and Drop Manhole Additional Depth	257	LF	\$250	\$64,000
Subtotal				\$111,000
Dewatering				
6 Foot Average Dewatering Depth	11,694	LF	\$25	\$292,000
Subtotal				\$292,000
Street Repairs				
Replace Asphalt Pavement	0	SY	\$45	\$0
Saw Cut, Remove, and Replace 8" Concrete	1,700	SY	\$65	\$111,000
Subtotal				\$111,000

BLACK & VEATCH

Lincoln, Nebraska
Lincoln Wastewater System
Beal Slough Relief Trunk Sewer Phases I & II
Opinion of Probable Project Cost
October 30, 2003

Alignment No. 2 - Phase II

<u>Item Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u> \$	<u>Total Cost</u> \$
Utility Relocation				
Miscellaneous Repairs and Relocations	1	LS	\$20,000	\$20,000
Subtotal				\$20,000
Miscellaneous				
Railroad Insurance and Flagging	40	Days	\$500	\$20,000
Seeding	51,973	SY	\$0.40	\$21,000
Fiber Optic Conduit	11,694	LF	\$7.00	\$82,000
Subtotal				\$123,000
Construction Cost Subtotal				\$3,497,000
Contingencies			15%	\$525,000
TOTAL CONSTRUCTION COST				\$4,022,000
ADDITIONAL PROJECT COSTS				
Right-of-Way Costs				
Permanent Easement	0	SF	\$1.00	\$0
Temporary Construction Easement	818,580	SF	\$0.10	\$82,000
Subtotal				\$82,000
Engineering, Legal, and Administrative Costs			20%	\$821,000
TOTAL PROJECT COST				\$4,925,000