Supplemental Engineering Report
No. 1

Water System Study
Supplemental, No. 1

Prepared for

City of Bridgeport
Morrill County, Nebraska

August 2007
OA Project No. 2005-1069

OLSSON
ASSOCIATES

OLSSON ASSOCIATES

29 August 2007

Mayor and City Council
Finley deGraffenried, City Administrator
City of Bridgeport
428 North Main Street
Bridgeport, NE 69336

RE: Bridgeport Water Study
Bridgeport, Nebraska
OA Project #2005-1069

Mayor and City Council Members:

We are pleased to present the Supplemental Engineering Report, No. 1 for the Bridgeport Water System Study in accordance with our agreement with the City of Bridgeport. We trust that it will include the information necessary for you to move forward in the decision making process of providing a new drinking water source for the City.

We would like to thank Finley deGraffenried, Wayne Kautz and the other City Employees for their time, consultation, and records used in the report preparation.

Sincerely,

Mike Milius

Mike Milius

Encl.

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ABBREVIATIONS

Abbreviations used in the report are as follows:

Cents	cts
ductile iron pipe	DIP
Department of Economic Development	DED
Environmental Protection Agency	EPA
Farmers Home Administration	FmHA
gallons per day	gpd
gallon	gal
gallons per minute	gpm
gallon per capita per day	gpcd
Ground Water Rule	GWR
Disinfection By Products	DBP
Lower Than Method Detection Limit	LTMDL
milligrams per liter	mg/l
million gallons	mg
micrograms/l	µg/l
million gallons per day	mgd
Maximum Contaminant Level	MCL
nitrogen	N
Nebraska Health and Human Services	NHHS
Insurance Service Office, Inc.	ISO
polyvinyl chloride pipe	PVC
pounds per square inch	psi
Safe Drinking Water Act	SDWA
degree centigrade	C
total dissolved solids	TDS
degrees Fahrenheit	F
electrical conductivity	EC
micromohs per centimeter	umhos/cm
nepholmetric turbidity units	NTU
haloacetic acids	HAA
silt density index (15 minutes)	SDI
oxidation-reduction potential	ORP
color units	cu
millivolt	mV
total organic carbon	TOC
picoCuries liter = a measure of radioactivity	pCi/l
trihalomethane(s)	THM
standard cubic feet per minute	scfm
Public Water System	PWS

Hardness in mg/l of calcium carbonate ($CaCO_3$) equivalent

Cations are (electrically) positively charged ions such as calcium, magnesium, and sodium.

Anions are (electrically) negatively charged ions such as chloride, sulfate, bicarbonate, and nitrate.

I. PURPOSE AND SCOPE

1. Based on the economic evaluation presented in Section VIII of the Engineering Report, the most cost effective conceptual alternative is central treatment. When treatment is considered, it makes the most sense to stay as close to town as possible and consolidate wells to facilitate central treatment. To accomplish this, both the aquifer characteristics and water quality is needed to fully assess the treatment options.

   Three (3) sites near Bridgeport were selected for possible well field development. Preliminary site evaluations were completed by OA and by the Department of Health and Human Services. Although preliminary, all three sites appear to be acceptable for development. However, the City's first choice was in the northeast part of town near the baseball fields. The site(s) are reasonably close to the distribution system, the 250,000 gallon storage tank, an existing well and a treatment site. These are all important factors since treated water will be entering the system from one location verses multiple locations.

   The following tasks were completed and are presented in this "Supplemental Engineering Report."[1]

   Site Analysis & Selection
   Field Verify Sites
   Limited Field Testing of Existing/Adjacent Wells
   Test Hole Drilling Program Design
   Stake Test Hole Site
   Observation of Drilling
   Test Well Pumping
   Well Schematics
   Evaluate Test Hole Data
   Well Field Layout
   Rank Potential Sites
   Phase I ESA – Not in this report but is under separate cover.
   Water Treatment

2. Well consolidation will include the construction of new wells and possibly the use of one existing municipal well. At a minimum the firm capacity should be equal to the "Total Maximum Daily Demand" of 1990 gpm. The City should consider petitioning the NHHS to allow the use of

[1] Only the updated sections are included in the Supplemental Engineering Report. Reference the Preliminary Engineering Report for additional information.

existing raw water wells for emergency fire protection. If NHHS does not allow their use, additional storage should be considered.

3. The hydraulic analysis on the distribution system was refined based on the selected location of the treatment site and raw water wells.

4. The study results, including detailed cost opinions for the recommended alternative, are published in this report.

SUMMARY OF FINDINGS AND RECOMMENDATIONS

Findings

1. Based on results from the test and observation well program, the aquifer in the northeast part of town will support the development of two (2) additional 1,000 gallon per minute raw water supply wells. The new wells, combined with the existing 1,000 gallon per minute located in City Park, will provide a firm capacity of 2,000 gallons per minute. The location of the wells will facilitate centralized treatment and supply treated water back into the distribution system.

2. The size of pipelines at and around the treated water entry point and in locations around existing wells will need to be increased to accommodate centralized flow.

Recommendations

1. Install two (2) additional 1,000 gallon per minute raw water supply wells and re-habilitate Well G-30031 (No. 69-1 City Park.) For this study, cost estimates are provided to re-drill the well.

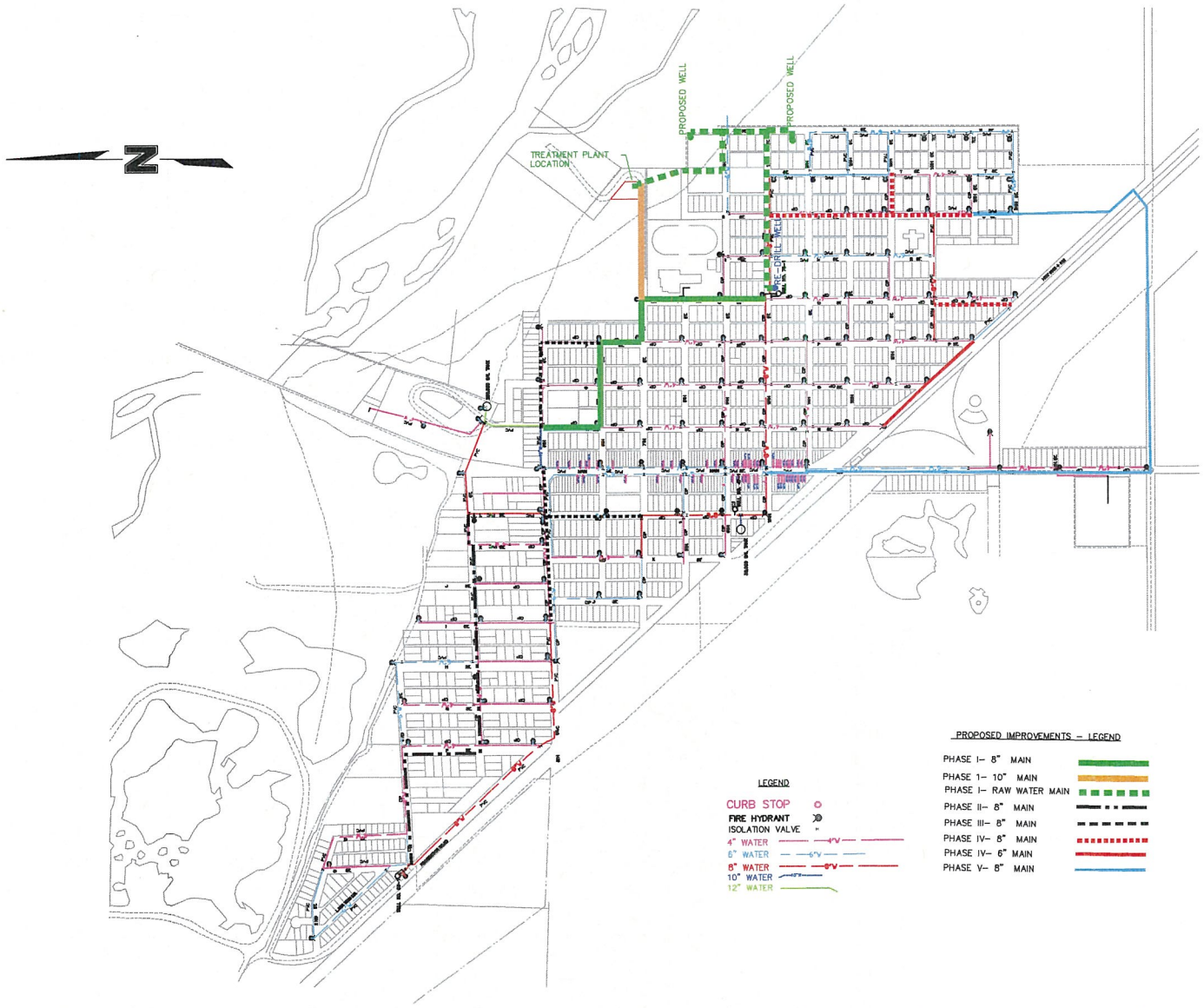
2. The recommended water treatment process is ion exchange (IX) with on-site regeneration. The 20 year present worth analysis suggests that brine waste disposal hauled to a uranium recovery mill or treated and discharge to the river are both feasible alternatives. Therefore, both alternatives will be further evaluated in the design phase.

   To confirm the water treatment recommendation a pilot test should be conducted to determine the following:

   · Cost of operation
   · Ease of operation
   · Stability of the process
   · Chemical usage
   · Waste brine characteristics and volume
   · Time between regenerations

   It is also recommended the City begin negotiation with Crow Butte Resources, Inc. to develop a long-term agreement to take the brine waste.

3. Install raw water pipelines and potable distribution pipelines to accommodate the wells and centralized treatment as illustrated Figure I-1. A detail description of proposed improvements and costs are presented in Section VIII.



PROJECT: 2005–1069 DRAWN BY: CIM DATE: 10/14/06	CITY OF BRIDGEPORT – PROPOSED IMPROVEMENTS	OLSSON ASSOCIATES	FIGURE I–1

V. SYSTEM DEFICIENCIES

General

The hydraulic analysis of the existing distribution system was rerun for the current and design year 2027 maximum day demand and selected proposed improvements the new results are presented in the section. The net deficiencies for the existing system with recommended improvements are shown in Table V-1a.

TABLE V-1a

Recommend Improvements - Supply
Net Deficiency - 3 Hour Fire Demand

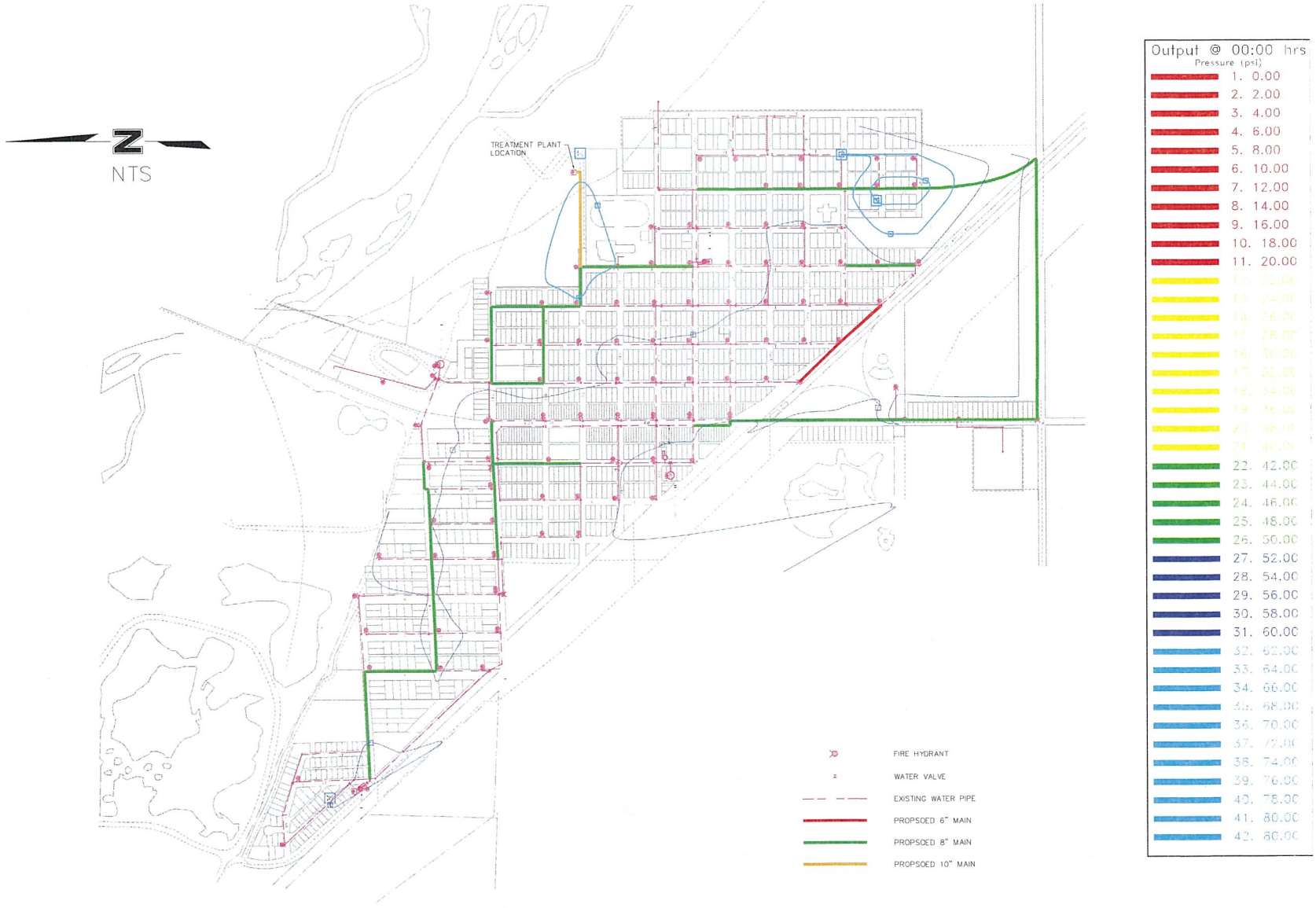
	2006	2015	2025	2027
Max Daily Demand & Fire Demand (gpm)	5,400	5,403	5,475	5,490
Potable Well Capacity (gpm) (Two new 1000 gpm + Existing Park Well)	3,000	3,000	3,000	3,000
Normal Daily Operation - Firm Capacity (gpm)	2,000	2,000	2,000	2,000
Emergency Well Capacities (gpm) Well 47-1, 1000 gpm Well 80-1, 750 gpm	1,750	1,750	1,750	1,750
Total Firm Fire Pumping Capacity, gpm	3,750	3,750	3,750	3,750
Deficiency (gpm)	1,650	1,653	1,725	1,740
Deficiency - 3 Hours (gallons)	297,000	297,584	310,501	313,163
Storage 85% Available (gallons) (250,000 + 50,000 Gal Tanks)	255,000	255,000	255,000	255,000
Net 3 Hour Surplus (gallons)	-42,584	-55,501	-58,163	-58,163
Net 3 Hour Surplus (gpm)	-237	-308	-323	-323

HYDRAULIC RUNS

Summary of updated Hydraulic Runs

Figure	Description
V-3	Current Max Day Proposed Improvements
V-3a	Future Max Day Proposed Improvements

The pipe/node data is presented in Appendix "C".



PROJECT: 2005-1069 DRAWN BY: CIM DATE: 10/14/06	CITY OF BRIDGEPORT – CURRENT MAX DAY PROPOSED IMPROVEMENTS	OLSSON ASSOCIATES	FIGURE V-3

PROJECT: 2005-1069 DRAWN BY: CIM DATE: 10/14/06	CITY OF BRIDGEPORT – FUTURE MAX DAY PROPOSED IMPROVEMENTS	OLSSON ASSOCIATES	FIGURE V-3a

VI - WELL FIELD EVALUATION

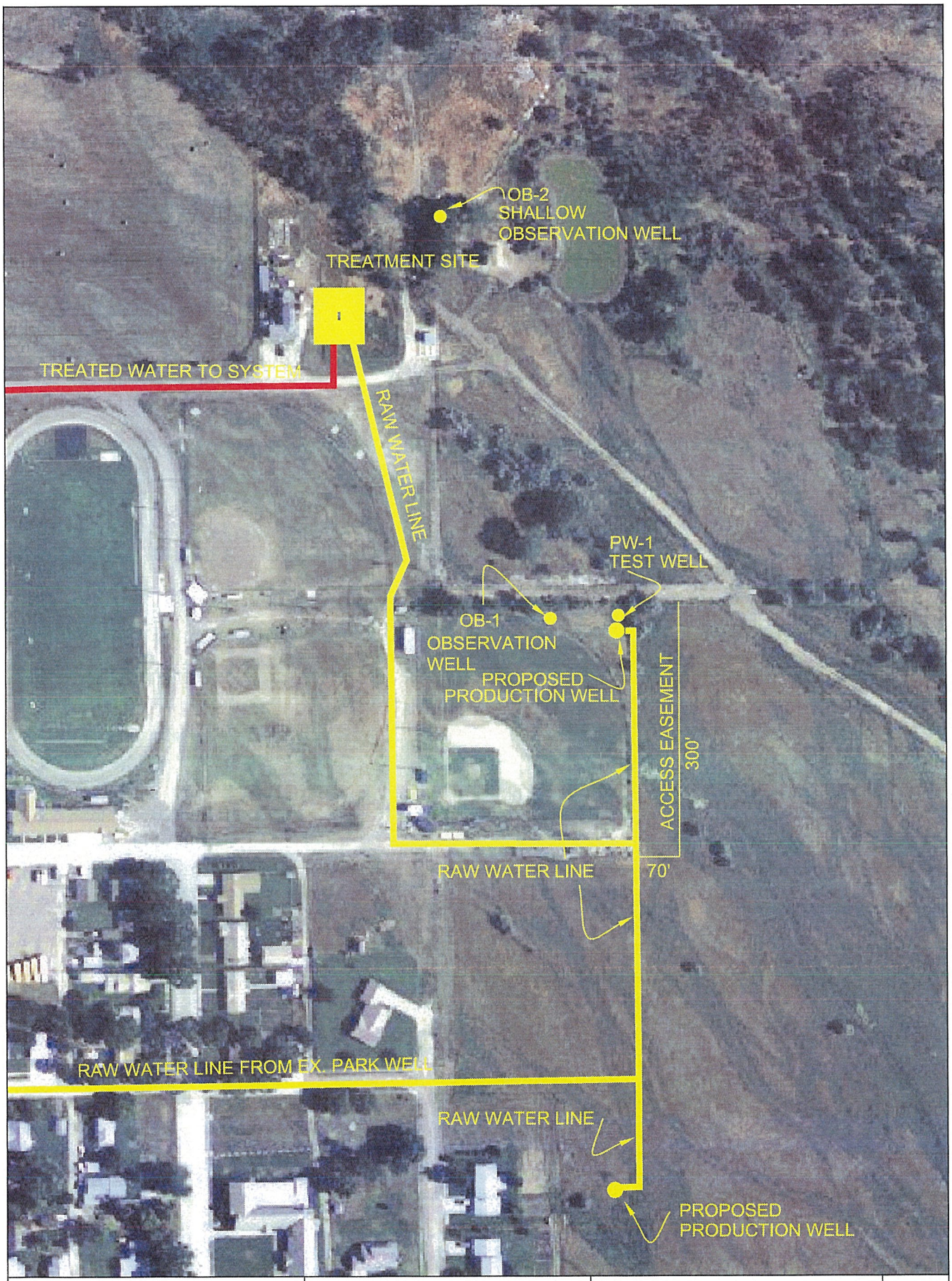
Background

Based on the economic evaluation presented in Section VIII of the Engineering Report, the most cost effective conceptual alternative is central treatment with raw water supply wells constructed adjacent or within the proximity of the treatment plant. Based on the recommendations of this report, test wells were constructed near the treatment site and tested to determine aquifer characteristics and water quality. Presented in this section are the finding and recommendations from data collected during the test hole drilling program. The well sites were presented to and approved by NHHS.

Test-Hole Drilling and Installation

A test-hole drilling, installation and testing program was implemented at the proposed well site illustrated in Figure VI-1. Three test wells were installed on the site to evaluate aquifer properties. On April 30, 2007, PW-1 (pumping well) was installed northeast of the baseball diamond and OBS-1 (deep observation well) was installed approximately 109 feet due west. On May 1, 2007, OBS-2 (shallow observation well) was installed approximately 300 feet west and 490 feet north of PW-1. During drilling, samples were collected continuously at 10 foot intervals for geotechnical sieve analysis and the lithology of the boreholes was logged by the onsite geologist. Appendix F-1 (to this section) includes copies of the boring logs and well construction diagrams. Appendix F-2 includes Sargent Drilling Company's well drilling reports, electric logs and well registrations. PW-1 is a 6-inch diameter test well with 40 feet of 32-slot screen installed from approximately 60 to 100 feet below ground surface (BGS). OBS-1 and OBS-2 are 2-inch diameter observation wells with 20 feet of 20-slot screen from 80 to 100 feet BGS in OBS-1 and 10 feet of 20-slot screen from 5-15 feet BGS in OBS-2.

During drilling, stratified fine, medium and coarse grained sand and gravel alluvial deposits were encountered from the ground surface to approximately 105 feet BGS. Gravel content increases with depth and gravel fragments reach 1.5 inches in diameter at the base of OBS-1. Bedrock is the Brule Formation consisting of interbedded siltstones and mudstones. The average depth to static water in the three wells was approximately 4 feet BGS as measured on May 4-7, 2007. The average aquifer saturated thickness was 97.5 feet.



PROJECT: 2005–1069		SITE LOCATION MAP TEST, OBSERVATION & PROPOSED PRODUCTION WELLS	FIGURE VI-1
DRAWN BY: GG	REVISIONS:		
DATE: 04/13/07			

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72-HOUR Continuous Rate Pumping Test

A 72-hour pumping test that began at 11:00 on May 7, 2007 was performed on PW-1 at a constant pumping rate of 430 gallons per minute. Water was discharged in a pasture 350 feet east of PW-1. Water levels were measured in the pumping and observation wells throughout the pumping test. Water levels were measured as the wells recovered from the pumping test from 11:00 on May 10, 2007 when the pump was turned off through 2:00 on May 14, 2007 During the pumping test, the maximum drawdown in pumping well PW-1 was 9.4 feet. In the observation wells, the water level was drawn down 0.89 feet in OB-1 (109 ft away from the pumping well) and 0.28 feet in OB-2 (600 feet from the pumping well). Water quality samples were collected from the wells before, during and after the pumping test. Water quality results are presented in Appendix F-4 of this report.

Pumping Test Analysis And Aquifer Parameters

The pumping test data was analyzed by using Theis analysis with Jacob Correction and the Boulton methods. Copies of the analysis are included in Appendix F-3. The recovery data was analyzed using Theis recovery method. Table VI-1 lists the aquifer parameters calculated based on each analysis and a geometric mean (average) value for each.

Table VI-1 Estimated Aquifer Parameters

Evaluation Method	Transmissivity (gpd/ft)	Hydraulic Conductivity (ft^2/day)
Boulton – OB-1	57,700	592
Theis with Jacob Correction – OB-2	53,800	552
Theis Recovery – PW-1	65,500	672
Theis Recovery – OB-1	98,700	1,010
Geometric Mean Value	**66,931**	**686**

Proposed Well Construction Details And Well Yield Estimates

Alloy Screen Technologies reviewed the sieve analysis and provided the following well construction recommendations:

Screen Ø:	18 inch
Screen length:	30 feet
Screen Slot:	90 (0.090")
Open Area:	313.2 sr. in./ft. or 46%
Transmitting Capacity:	97.1 GPM/ft @ 0.1'/sec
	30' x 97.1 = 2913 GPM
	@ 50% plugged = 1457 GPM

Bottom of screen depth set from 70 to 100 ft BGS

Well screen should have a minimum collapse strength of 20 psi

Filter pack similar to Northern #3 Well Pack (Northern Gravel, Muscatine, IA)

Based on the sieve analysis, the estimated well yield should be 32 to 43 per gpm/foot of drawdown. The actual well yield measured during the pumping test was 45 gpm/foot of drawdown.

Well Siting

After a review of several sites the City selected the proposed areas. The selection was based on the site's proximity to the river and existing distribution system, being able to utilize an existing high volume municipal well and land ownership. The relative short distance to the river facilitates disposal of waste from some of the treatment plant alternatives.

The former City of Bridgeport solid waste dump is located approximately 600 feet northwest of proposed well site #PW-1. Based upon a review of historical aerial photographs, the former dump, was in operation between the 1950's and 1990's. The former dump area no longer accepts municipal solid waste and is only used for storage of tree branches and broken concrete. Solid waste generated by the City of Bridgeport is now hauled to J-Bar-J landfill in Ogallala, NE.

Water quality testing completed on observation well #2 installed near the southeast corner of the former dump indicates that no volatile organic compounds were present. However no full scale

water quality testing has been completed across the former dump and may not represent the water quality across the entire former dump and downgradient of the dump.

Water quality testing completed on the test well PW-1 at the proposed well site did not indicate that water quality has been influenced by the dump. The water quality test results are presented in Appendix F-4.

As discussed in the 72-HOUR Continuous Rate Pumping Test, a drawdown of 0.25 feet was observed in OB-2 at a pumping rate of 430 gallons per minute. A computer simulated drawdown test indicated a drawdown of approximately 0.75 feet at a pumping rate of 1000 gpm.

Although there is no indication of ground water impacts from the dump at the current time, there is no guarantee that long term pumping will not change water quality characteristics.

VII. WATER TREATMENT PLANT SUPPLEMENTAL EVALUATION

A. Water Treatment Plant Site Location

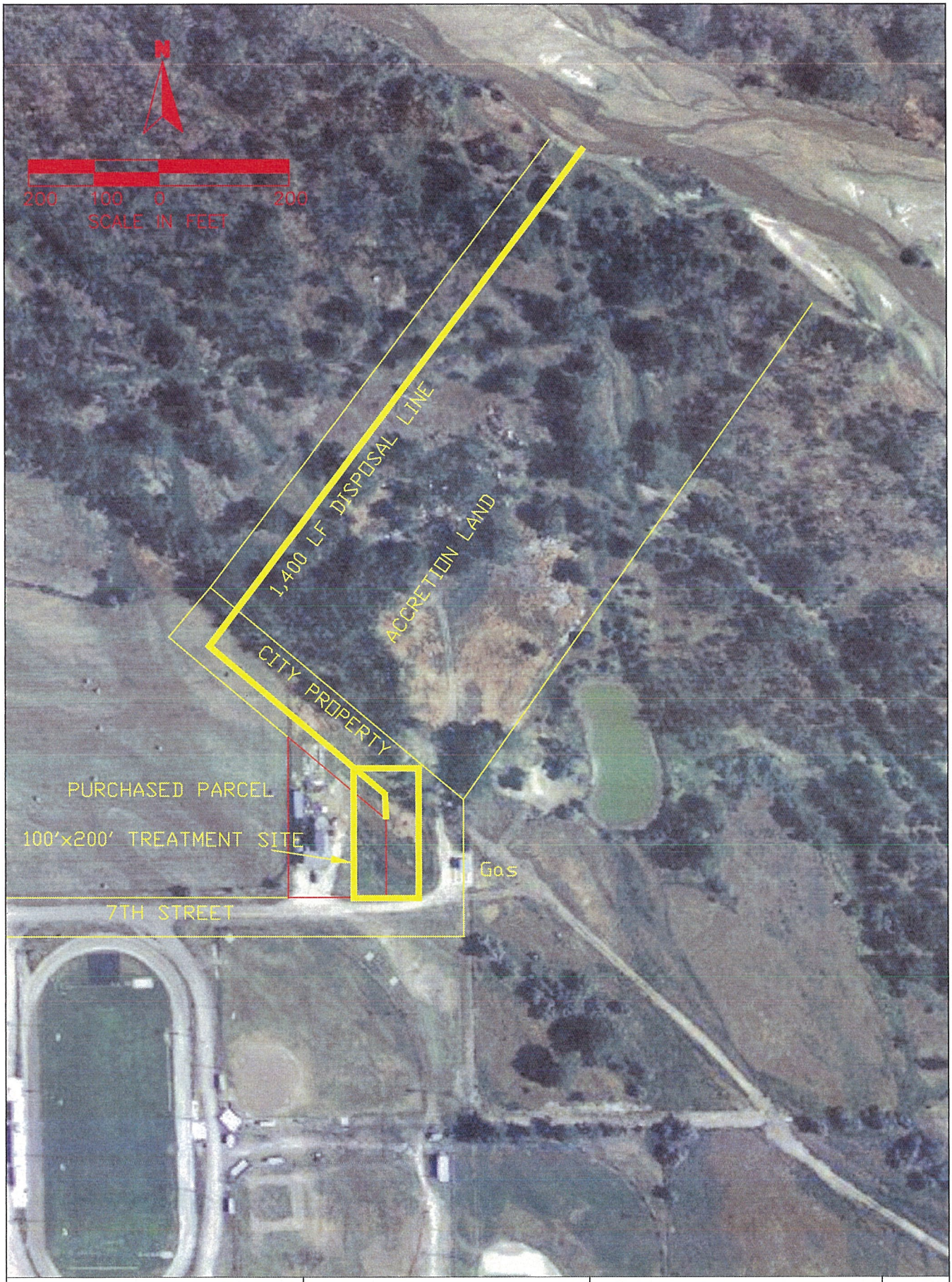
Several sites were reviewed as potential locations of the new municipal water wells during this study. The selection of the site for the water treatment plant is based on the proximity of the site to the new water wells and to the existing Well 69-1. Other criteria included availability of the land, proximity of the distribution system, existing roads and utilities. With the possibility of discharging the water treatment waste stream to the North Platte River, it was desirable to locate the treatment plant close to the river to shorten the length of the outfall sewer if needed. Figure VII-1 shows the selected location of the water treatment plant in relation to the wells, access roads and the city.

B. Water Treatment Process Evaluation

Now that a specific site has been selected for the Water Treatment Plant and new water quality data have been obtained from the test wells, the available treatment processes will be further evaluated and revised opinion of costs will be provided. Equipment needed for the water treatment process will be determined. The treatment process will be evaluated using site specific constraints and water quality parameters. Pretreatment of the raw water will be reviewed and analyzed. Operation and maintenance requirements and costs will be determined. Permits needed and other requirements for waste disposal will be determined. Contact will made with facilities which may be able to accept the spent resins containing Uranium to determine the costs associated with the resin disposal and any special provisions.

Olsson's research indicates that enhanced coagulation/filtration (CF)[1], Lime Softening (LS), regenerating and non-regenerating ion exchange (IX) and reverse osmosis (RO) are the technologies listed as Best Available Technologies (BAT) by the EPA. However, ion exchange is the only technology that appears to have been implemented at full-scale operating plants specifically designed for uranium removal. Also, as previously presented in the November 2006, Water Study Report, IX was shown to be the most economical solution, at the time, based on the preliminary capital and O&M costs provided.

[1] Enhanced coagulation/filtration and Lime Softening were not presented in the previous November 2006 Water Study Report because the use of this technology for uranium removal for small systems is considered only practical if the system has coagulation/filtration or lime softening in place and can modify the existing processes to optimize uranium removal.



PROJECT: 2005–1069	SITE LOCATION MAP TREATMENT SITE BRIDGEPORT, NEBRASKA	OLSSON ASSOCIATES 115 Railway Street P.O. Box 2303 Scottsbluff, NE 69363-2303 TEL 308.635.2627 FAX 308.635.2665	FIGURE VII–1

1. Revised Design Criteria

Plant Capacity - Based upon the design criteria established in Section IV of the November 2006 Water Study Report, the treatment plant design capacity was proposed to meet the projected year 2027 Peak Day Demand of 2.15 MGD and a projected Average Day Demand of 0.72 MGD. A 500 gpm industrial demand was proposed in the future flow projections. This additional flow is currently not included in Peak Day Demand used in the proposed design of the treatment alternatives. During final design, provisions will be made for treatment process expansion to accommodate the additional industrial flow if this was ever to come to fruition.

Revised Raw Water Quality Data - Table VII-1 summarizes the revised water quality for Well 69-1, the test well, and the projected combination of the proposed flow from the new well with that of Well 69-1. This assumes that the water quality in the new well will be equal to that of the test well. The right-most column on the table shows the raw water quality assumed as the basis for preparing a conceptual treatment process design.

Table VII-1

WATER PRODUCTION RATES AND QUALITIES FOR COMBINATIONS OF OPERATING WELLS				
Operating Wells	**69-1**	**New Wells[1]**	**69-1 & New well**	**Assumed Design Well Water Quality**
Flow (gpm)	1,000	1,000 (ea)	2,000	
Constituent Concentrations (mg/l except as noted)				
Calcium	127	136	131.5	136
Magnesium	30.5	21.6	26	30
Sodium	198	137	167	198
Bicarbonate	455	376	415	455
Sulfate	362	370	366	370
Chloride	46	41	43.0	45
Nitrate	8.0	3.1	5.6	8
TDS	1050	929	990	1100
Hardness as $CaCO_3$	443	440	442	440
pH	7.67	7.62	7.65	7.65
Arsenic	3.4	3.8	3.6	3.8
Barium	ND	ND	ND	ND
Iron	ND	.05	0.025	0.05
Uranium	73.7	77.8	75.2	80

[1] Assumes that the water quality in the two new wells will be very similar to the water quality results of the test well.

Specific water quality goals include:

- Uranium less than 0.020 mg/l.

2. Ion Exchange (IX) Treatment Recap

Ion exchange is a physical/chemical process in which ions held electrostatically on the surface of a solid are exchanged for ions of similar charge in a solution.

There are two basic types of IX:

- *Cation exchange* affects positively charged ions (cations), such as calcium, magnesium (the hardness causing ions), sodium, potassium, etc.
- *Anion exchange* affects negatively charged ions (anions) including nitrate, sulfate, chloride, bicarbonate, arsenate, uranate (uranium), etc.

Dissolved salts in water exist as either cations or anions. For example, sodium chloride (common table salt), when dissolved in water, becomes sodium cations and chloride anions.

IX, as the name implies, relies on exchanging one ion for another ion. IX is usually accomplished in pressure vessels. The vessels contain IX resin that is made of a synthetic material that has "exchange sites". At startup, the exchange sites have an ion that is to be exchanged for ions in the water to be treated. For example, arsenate, sulfate, and uranium, which are present in water as anions, are usually removed by exchanging chloride for these three contaminants.

Uranium is usually present in water as an anion. Accordingly, anion exchange has been shown to be effective at reducing uranium concentrations in well water by more than 95%. The regenerating chemical is typically sodium chloride (NaCl).

The resins have a finite exchange capacity. Eventually, the resins become exhausted (Exhaustion occurs when all or most of the "exchange sites" on the resin have been used up.) and must be *regenerated or replaced* so that more water can be treated. Regeneration is accomplished by passing a chemical solution through an exhausted resin. The appropriate cation (or anion) in the regenerating solutions displaces the undesirable cations (or anions) removed from the water that was treated and the more desirable cation (or anion) in the regenerating solution takes the displaced cation's (or anion's) place on the resin. After rinsing, the IX resin is ready to treat more water. The regeneration process produces a wastewater stream that requires disposal.

A disadvantage of on-site regenerating IX is that salts (regenerating chemicals) are imported into the region where the IX plant is located. The TDS of the treated water can be greater than the TDS of the raw water. Essentially, all of the sodium from the salt (plus the nitrate, arsenate, uranium, chloride and TDS exchanged from the raw water), end up in the waste stream. This liquid waste stream will be difficult for the City of Bridgeport to dispose of easily. The high TDS, uranium, sodium, and chloride concentrations of this waste stream prevents direct discharge into the North Platte River without additional processing such as dilution before discharge. Other options

would include further concentrating the brine waste for off-site disposal or deep well injection.

Non-regenerating IX processes requires that the IX resin, which has become laden with the uranium anions, be removed and disposed of properly. The exhausted resin is replaced with new or regenerated resin. This is operating the IX process as an adsorption process and since the process accumulates a radioactive material, the operation will need to be closely monitored.

The Nuclear Regulatory Commission (NRC) has thresholds for being exempt from the regulations and certain licensing requirements for materials that are not exempt depending on the amount of uranium collected. Department of Transportation (DOT) regulations govern the shipping, labeling, and transport of hazardous (including radioactive) materials and has certain thresholds for exemption of the regulations. The resin disposal requirements will be different depending on the classification of this solid waste and permits may be required.

3. IX Residuals Disposal

Removing the uranium from the drinking water is not the most challenging part of the IX treatment process. The most challenging and perhaps costly part is the disposal of the residual wastes from the treatment process.

Waste disposal is one of the single most important considerations in the treatment selection process. Regardless of the technology used, the process of removing uranium from drinking water will generate a waste stream, also called residuals, containing concentrated uranium. There are many site-specific variables that can affect the ultimate concentration of uranium in the residuals, and the resulting health and safety risks they pose.

Intermediate processing may be necessary prior to disposal by some or all of these alternatives. Most intermediate processing concentrates contaminants into a smaller volume for disposal, usually producing two waste streams: a "cleaner" liquid waste stream and a more concentrated solid waste stream. Economics, disposal alternatives, and regulations will dictate the extent of intermediate treatment.

Intermediate processing for liquid wastes may include:

- Flow equalization - Large spikes in flow quantity or contaminant concentration

may interfere with publicly owned treatment works (POTW) treatment. Therefore, detaining and mixing water system wastes may be necessary prior to release to a POTW.

- Brine recycling - Water systems may be able to reuse brine rinse, reducing the total amount of brine that must be disposed. However, caution should be used because the reused brine streams may contain higher levels of suspended solids and contaminants, which may limit disposal options.

- Settling or gravity thickening - Settling basins or mechanical presses may be used to remove suspended solids and contaminants from liquid waste streams, resulting in a sludge and a cleaner liquid waste.

- Evaporation - In hot or dry climates, evaporation can enhance settling basins by removing water and leaving solids and contaminants.

- Chemical precipitation - Coagulants can be added to remove contaminants from liquid waste streams and precipitate them as sludges.

Due to various combinations of water characteristics, treatment technologies, and intermediate processing options, the residual characteristics are difficult to predict. Generally, however, the residual disposal options are governed by three factors: (1) the solid content of the uranium-bearing waste stream, (2) the concentration of uranium, and (3) the presence of other chemical or radiological contaminants.

Uranium removal with IX can produce liquid and solid waste streams including the brine regenerant stream, fast and slow rinse streams, backwash stream, and spent media. These wastes have the potential for being classified as hazardous and can pose disposal problems. Table VII-2 provides a summary of the available waste disposal options. These are further discussed in the following paragraphs.

Table VII-2

WASTE DISPOSAL OPTIONS	
Waste Type	**Disposal Method**
Liquid	Direct Discharge to Surface Water
	Indirect Discharge to POTW
	Evaporation Ponds
Solid (Spent Media)	Landfill (Municipal or Hazardous)
	Uranium Recovery Mill

Liquid residuals are created when the uranium remains dissolved in the water, although at a higher concentration than before the treatment. Liquid residuals arise from the membrane reject stream from reverse osmosis, the brine regeneration waste stream from ion exchange, and the various rinses and backwashes required for ion exchange and treatment methods utilizing precipitation.

The Atomic Energy Act of 1954, as amended, requires the Nuclear Regulatory Commission (NRC) to regulate the civilian commercial, industrial, academic, and medical use of nuclear materials. The Act enables the NRC to relinquish some of its regulatory authority over source materials to states through the signing of an agreement between the state's Governor and the NRC Chairperson. Currently, 33 states have entered such agreements and are referred to as "Agreement States." Nebraska is an "Agreement State". Agreement States must establish radiation protection programs compatible with the NRC's program and the NRC remains involved with state licensing, inspection, and rule changes, among other things.

The source material (uranium containing residual) is deemed an **"unimportant quantity"** and is exempt from NRC regulation if the uranium makes up less than 0.05 percent by weight (or approximately 335 pCi/g for natural uranium) of the material. These limits apply to both liquid and solid residuals.

If the source material contains more than 0.05 percent uranium by weight, but no more than 15 pounds at any time nor more than 150 pounds per year, it is considered a **"small quantity"** and is subject to the **"general license"** requirements of 10 CFR 40.22, including disposal at facilities authorized to accept Low Level Radioactive Waste.

Systems that exceed the unimportant quantity and small quantity thresholds must apply for **"specific licenses"** from the NRC or Agreement State.

Liquid waste streams which have radioactive material must have lower concentrations than the Nuclear Regulatory Commission (NRC) disposal limits (300 pCi/l for deep well injection and 3,000 pCi/l for discharge to sanitary sewer) in order for the waste to be classified as non-hazardous.

The EPA suggested the possibility of an exemption from specific licensing for water treatment facilities. However, the NRC has not yet defined how systems would apply for such an exemption. In a March 2006 recommendation to the Commission, NRC staff recommended creating a new interim general license specific to drinking water facilities, but, in April, the Commission ordered staff to follow the normal rulemaking process, with the goal of having a rule in place within 20 months (presumably late 2007 or early 2008).

Disposing of residuals can be a very significant portion of the cost of treating water. Minimizing disposal costs is important to minimizing the final cost of water delivered to the end users.

There are five realistic methods for the disposal of uranium laden waste streams for the City of Bridgeport.

Direct Discharge to Surface Waters

Direct discharge refers to the disposal of liquid waste streams to nearby surface waters, which act to dilute and disperse the waste by-products. The primary advantage of direct discharge is reduced capital and operations and maintenance (O&M) costs due to the elimination of residuals treatment. The feasibility of this disposal method is subject to provisions of the National Pollutant Discharge Elimination System (NPDES) and state anti-degradation regulation. The allowable discharge is a function of the ability of the receiving water to assimilate the waste products without exceeding water quality criteria established under the Clean Water Act (CWA) or state regulation. Different water quality criteria exist depending on the classification of the receiving water. Nebraska has developed designated use

numeric water quality standards that limit the amount of contaminants that may be discharged to surface waters. Each surface water in Nebraska that is chosen for each of the designated uses must meet the corresponding contaminant limit specified (discharges that cause a violation are prohibited). Thus, each NPDES permit issued to a Drinking Water Treatment Plant that directly discharges pollutants to surface waters in Nebraska must ensure that the effluent discharged by that facility does not cause a violation of the corresponding standard.

In addition to these numeric water quality standards, Nebraska also imposes narrative water quality standards applicable to surface waters in the state. Under these standards:

- Surface waters shall be free from toxic substances, alone or in combination with other substances, in concentrations that result in acute or chronic toxicity to aquatic life.

- Toxic substances shall not be present in concentrations that result in objectionable tastes or significant bioaccumulation or biomagnifications in aquatic organisms which renders them unsuitable or unsafe for consumption.

- Wastes or toxic substances introduced directly or indirectly into public drinking water supplies by human activity in concentrations that would degrade the use (i.e., would produce undesirable physiological effects in humans) shall not be allowed.

Any discharge of a residual that is deemed to violate these narrative standards would be prohibited or limited through NPDES permit conditions.

The Nebraska Department of Environmental Quality (NDEQ) has been contacted to get a determination as to whether the waste residuals from a IX water treatment plant would be allowed and if a NPDES permit could be obtained. The NDEQ did not indicate that it was impossible to get a permit because there is not a discharge limit established for uranium yet. They did indicate that there would need to be some secondary treatment of the waste since the waste could be very high in conductivity, chloride, nitrate, and TDS. Since the brine waste stream can be in the 35,000 to 40,000 mg/l range in TDS, a very large amount of dilution would be needed to be

able to discharge to the river.

At the current time, waste residuals from a RO treatment plant could be discharged to the river. Although secondary treatment may not be required, additional conditions may be added during the NPDES permit process.

Indirect Discharge

The discharge of liquid waste streams to a Public Owned Treatment Works (POTW) was reviewed. Waste residuals from an IX water treatment plant would contain high levels of chloride. Chloride would be detrimental to the wastewater treatment process. Therefore this disposal alternative is not considered feasible.

Waste disposal from an IX water treatment plant utilizing secondary treatment was also considered. Secondary treatment would consist of brine dilution with ground water and discharge to the North Platte River. This process would consist of daily backwash and monthly regeneration. Waste residuals from the daily backwash process are primarily particulates flushed from the media. A preliminary review suggests that particulates would not adversely impact surface water. Therefore, this waste stream would be directly discharged to the North Platte River without additional treatment. The waste stream generated from the regeneration process will require additional treatment. The chronic limit for chlorides is 230 mg/l. It is estimated the regenerate brine waste will have approximately 20,330 mg/l. This would require a dilution factor of 88 to be able to discharge this wastewater to the river. The Uranium concentration is estimated to be about 34,000 mg/l. Based on a dilution factor of 88, 0.46 gpm of regenerate wastewater would be blended with 40.7 gpm of clean water. Conceptually, this alternative is technically feasible and will be further reviewed to determine it's cost effectiveness.

Even though there is no limit on uranium discharge to the river, the NDEQ could develop new water quality criteria or modify existing criteria through site-specific analyses in order to more accurately protect the resident fish species.

Evaporative Ponds

Evaporative ponds are areas where liquid waste streams or other produced water is placed and dried by evaporation, leaving a residue of solids or sludge. An evaporative pond will operate most efficiently as a large shallow pond, which will require a large tract of land. Storage and handling of liquids in properly constructed pond is used as a means of removing solids and reducing liquid volume by evaporation. However, solids will eventually need to be dewatered and disposed of permanently. The ponds will need to be sized to accommodate flows plus a safety margin for heavy precipitation events or snowmelt, lining of the ponds will be required to prevent percolation of contaminants into underlying groundwater, and ponds will need to be constructed to prevent escape of impounded liquids. Evaporative ponds must be capable of being dewatered at appropriate intervals so that sediments can be dried and characterized to determine what type of ultimate disposal is appropriate for the solids. The amount of uranium in the residual sludge of the lagoons would need to be monitored to make sure the sludge does not ever exceed the NRC's regulations.

Landfill Disposal

Historically, municipal solid waste landfills have been commonly used for the disposal of non-hazardous solid wastes emanating from treatment processes. However, the hazard potential of uranium may limit the feasibility of this alternative.

Dewatered sludge and spent media can be disposed in a municipal solid waste landfill if the waste passes both the Paint Filter Liquids Test (PFLT) and the Toxicity Characteristic Leaching Procedure (TCLP). The PFLT is used to verify there is no free liquid residual associated with the waste. However, if the TCLP extract contains arsenic or any other regulated contaminants above their Toxicity Characteristic (TC), the waste residuals must be disposed in a designated and licensed hazardous waste landfill. These landfills are strictly regulated and have extensive monitoring and operational guidelines. As such, the costs of disposal are relatively high. As with municipal solid waste landfill disposal, waste sludge must not contain free liquid residuals.

A critical element of hazardous waste disposal is the cradle-to-grave concept. The party responsible for generating the hazardous waste retains liability and responsibility for the fate and transport of the waste.

NRC and DOT requirements will need to be met to keep this waste from having to be licensed for processing, disposal, and transportation.

Uranium Recovery

Once removed from drinking water, it is conceivable that the uranium could be extracted from the IX media or the regenerant brine waste, and recycled for industrial uses. The residuals that will result from ion exchange processes used at the water treatment facilities are expected to be physically, chemically, and radiologically similar to existing natural uranium produced from the processing of conventional ores. As a result, if the water treatment plant concentrate has enough uranium and significant volumes of material, it may be economically beneficial since to send the spent media to an uranium recovery mill rather than disposing of it and the current price for Uranium at $133 per pound,.

For this option to be economical, the concentration of uranium on the media will need to be brought to the limit. This will exceed the "unimportant quantity" threshold. The city would need to apply for a general license from the NRC or Agreement State. If the small quantity threshold is exceeded, then the city must apply for a specific licenses from the NRC or Agreement State. Also, the DOT governs the shipping, labeling, and transport of hazardous materials which includes radioactive materials. However, the DOT exempts, "other natural materials or ores... when these have been subjected to physical or chemical processing, when the processing was not for the purpose of extracting the radionuclides...provided that their radionuclide concentration does not exceed 10 times the activity concentration inactivity in the table in 49 CFR 173.436." Uranium is listed in the table in 49CFR 173.436 at 27 pCi/g. Therefore, a system would need to transport over 270 pCi/g of uranium before meeting the "10 times" exemption threshold.

Due to the large quantities of water treated at even the smallest drinking water treatment plants, removal of a high concentration of uranium can result in a waste stream containing hundreds of pounds of uranium a year. Consequently, when evaluating technical methods for removing uranium, the important regulatory threshold is considered to be the concentration limit of 0.05 percent by weight of

uranium. This means that as long as the resins are disposed of or replaced prior to the reaching a concentration of 0.05 percent of the total weight as uranium of the media, no NRC licenses would be needed. However, in order to transport the media, the DOT limit of 270 pCi/g would need to be met to be exempt from needed a permit.

4. **Opinion of Costs**

Five different water treatment and waste disposal scenarios were evaluated for comparison. These include:

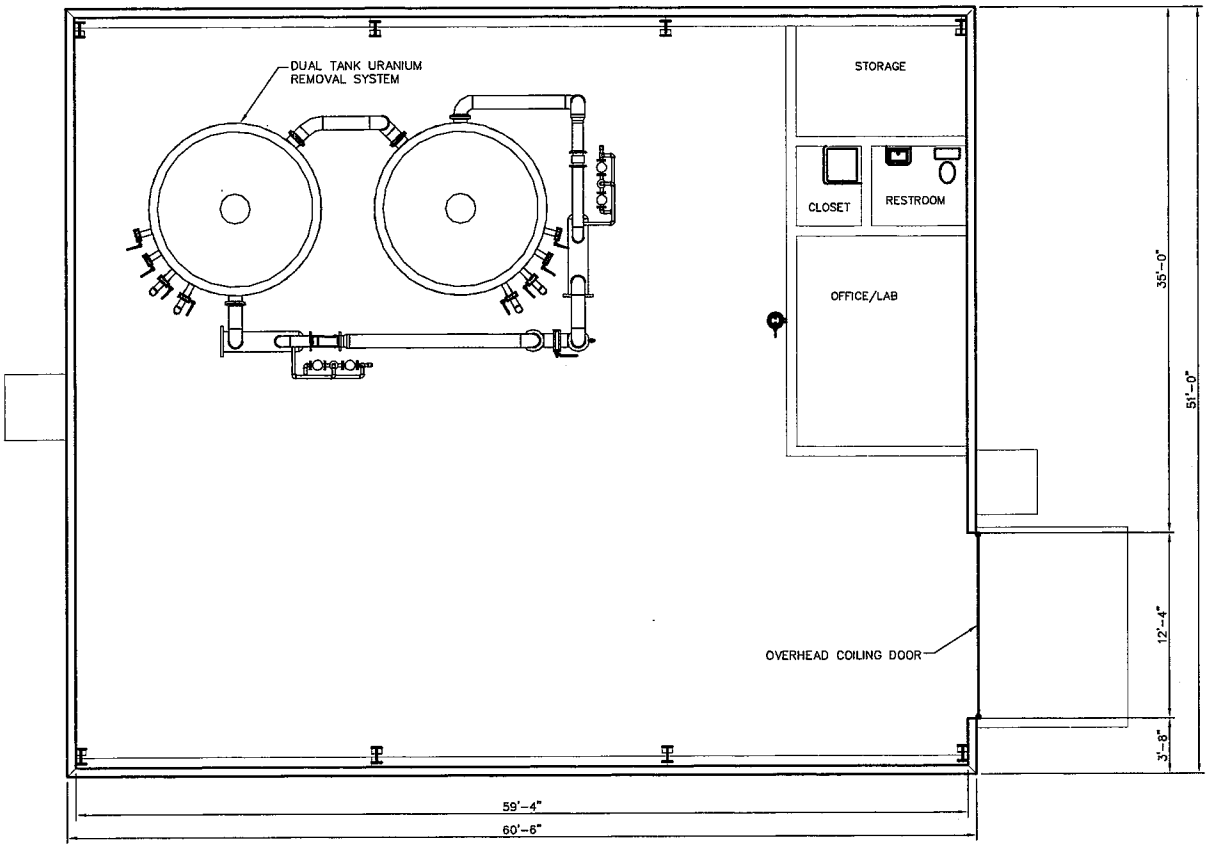
- IX with contracted media disposal.
- IX where City does media disposal.
- IX with on-site regeneration and haul brine waste to uranium recovery mill.
- IX on-site regeneration and discharge waste stream to the river.
- RO for removal of uranium and discharge waste stream to the river.

Conceptual level opinions of the capital and O&M costs for each treatment option to remove uranium are given in Tables VII-3 through VII-7. For purposes of preparing the cost opinions, it was assumed that the design capacity of the plant would be 2.15 MGD and the annual treated water production would be about 263 MGY.

OPTION 1 – One time with contracted media disposal.

The capital cost and O&M costs were developed for the IX treatment system where the media disposal is contracted with a disposal company and is shown in Table VII-3. This option is based on information provided by Water Remediation Technology, LLC. (WRT) of Wheat Ridge, Colorado. A copy of their proposal in included in Appendix G. A conceptual building layout for the non-regenerating IX treatment option is shown on Figure VII-2.

The costs presented in this section prefer only to treatment and waste dispoal. The total project costs are provided in VIII. Economic Evaluation Summary & Recommended Alternative.



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NON-REGENERATING ION EXCHANGE - FLOOR PLAN
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FIGURE
VII-2

Table VII-3

Conceptual Level Opinion of Capital and O&M IX (Contracted Resin Disposal)	
	Capital
IX Equipment	$1,185,000
Building to House Equipment	$175,000
Chemical Feed	$0
Power and Lighting	$60,000
HVAC	$75,000
Instrumentation and Controls	$35,000
Sanitary Sewer	$10,000
Subtotal-Construction	**$1,540,000**
Engineering and Contingencies Contingencies)	$539,000
Opinion of Capital Cost	**$2,079,000**
	O&M Cost
IX Plant Operation	$45,000
Resin Replacement	$0
Chemical Costs	$0
Contracted Media Disposal	$543,950
Electrical Power Costs	$28,000
Misc. Repairs, Analytical fees, Etc.	$10,000
Opinion of Annual O&M Cost	**$626,950**
O&M Cost /MG (Annual Production = 263 MGY)	**$2,384**

[1]Cost based on proposal provided by WRT
[2]IX is not considered a filtration process, so disinfection is not required.

OPTION 2 – One time with City media disposal.

The capital cost and O&M costs were developed for the IX treatment system where the City does the media disposal and is shown in Table VII-4. This option assumes that the system will be operated such that no Licenses or permits will be required by the NRC or the DOT. Conceptual design calculations indicate that the DOT regulation dictates that 13 media replacements will occur each year. There will be approximately 600 cubic feet of media to dispose of each time which equates to 289 cubic yards of resin for disposal of each year. Resin is estimated to cost approximately $250 per cubic foot. Disposal fees are estimated at $278 per cubic yard and hauling costs would be $3.15 per mile round trip. A conceptual building

layout for the non-regenerating IX treatment option is shown on Figure VII-3.

An alternate to disposing the resin at a landfill would the be to take it to an uranium recovery mill. Crow Butte Resources Inc., at Crow Butte, Nebraska was contacted to see if they would accept the resin. They indicated that they would be interested and that there may be no charge to dispose of the resin. However, they indicated that the resign could not be returned to the water treatment plant once it is delivered to their site. They also indicated that they have not had to change out their resins for over 15 years, so they where concerned about the quantity of the resins that would be hauled to their site. If they would have to dispose of the resin after they stripped off the uranium, they would have to add on a disposal fee.

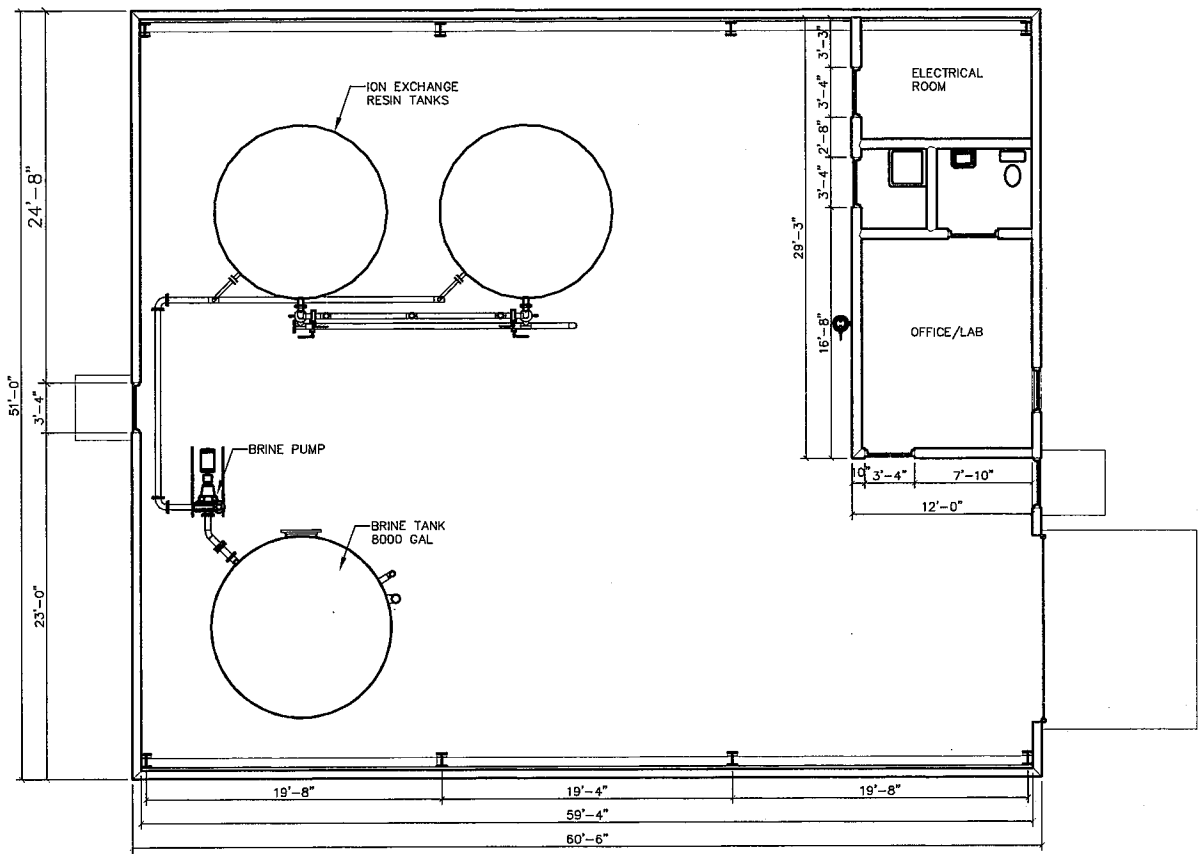
Table VII-4

Conceptual Level Opinion of Capital and O&M
IX (City does Media Disposal)

	Capital
IX Equipment	$730,000
Building to House Equipment	$175,000
Chemical Feed	$0
Power and Lighting	$60,000
HVAC	$75,000
Instrumentation and Controls	$35,000
Sanitary Sewer	$10,000
Subtotal-Construction	**$1,085,000**
Engineering and Contingencies	
Contingencies	$379,750
Opinion of Capital Cost	**$1,464,750**
	O&M Cost
IX Plant Operation	$45,000
Resin Replacement	$1,950,000
Chemical Costs	$0
Media Disposal Costs (Haul & Disposal Fees)	$84,500
Electrical Power Costs	$28,000
Misc. Repairs, Analytical fees, Etc.	$10,000
Opinion of Annual O&M Cost	**$2,117,500**
O&M Cost /MG (Annual Production = 263 MGY)	**$8,051**

OPTION 3

The capital cost and O&M costs were developed for the IX with on-site regeneration treatment system where the City stores and then hauls the brine and slow rinse waste to an uranium recovery mill and is shown in Table VII-5. This option assumes that the system will be operated such that no Licenses or permits will be required by the NRC or the DOT. Conceptual design calculations indicate that the NRC regulation dictates that 10 regenerations will occur each year. There will be approximately 18,813 gallons of brine and slow rinse waste water to dispose of each time which equates to 188,125 gallons each year. Hauling costs would be $3.15 per mile round trip to Crow Butte mine. Backwash and fast rinse waste water will be discharged to the sanitary sewer. A conceptual building layout for the regenerating IX treatment option is shown on figure VII-3.



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REGENERATING ION EXCHANGE - FLOOR PLAN
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FIGURE
VII-3

Table VII-5

Conceptual Level Opinion of Capital and O&M IX (Onsite Regeneration & Haul Off Brine)	
	Capital
IX Equipment w/ Regeneration	$880,000
Building to House Equipment	$190,000
Brine Waste Storage	$50,000
Chemical Feed	$0
Power and Lighting	$60,000
HVAC	$75,000
Instrumentation and Controls	$35,000
Sanitary Sewer	$10,000
Subtotal-Construction	**$1,300,000**
Engineering and Contingencies Contingencies)	$455,000
Opinion of Capital Cost	**$1,755,000**
	O&M Cost
IX Plant Operation	$45,000
Resin Replacement	$0
NaCl Costs	$3,000
Brine Disposal Costs (Haul cost only to Crow Butte)	$15,120
Electrical Power Costs	$28,000
Misc. Repairs, Analytical fees, Etc.	$10,000
Opinion of Annual O&M Cost	**$101,120**
O&M Cost /MG (Annual Production = 263 MGY)	**$384**

OPTION 4

The capital cost and O&M costs were developed for the IX with on-site regeneration treatment system where the all residual wastes are discharged to the sanitary sewer and is shown in Table VII-6. This option assumes that the system will be operated such that no Licenses or permits will be required by the NRC. Conceptual design calculations indicate that the NRC regulation dictate that 10 regenerations will occur each year. There will be approximately 18,812.5 gallons of brine and slow rinse waste water to dispose of each time. Backwash and fast rinse waste water will also be discharged to the sanitary sewer. Total annual discharge is estimated to be

5,564,000 gallons each year. A conceptual building layout for the regenerating IX treatment option is shown on Figure VII-3.

Table VII-6

Conceptual Level Opinion of Capital and O&M IX (Onsite Regeneration & Discharge to River)	
	Capital
IX Equipment w/ Regeneration	$880,000
Building to House Equipment	$190,000
Chemical Feed	$0
Power and Lighting	$60,000
HVAC	$75,000
Equalization Tank	$30,000
Outfall Sewer & Dilution Well	$15,000
Instrumentation and Controls	$35,000
Subtotal-Construction	**$1,285,000**
Engineering and Contingencies Contingencies)	$449,750
Opinion of Capital Cost	**$1,734,750**
	O&M Cost
IX Plant Operation	$45,000
Resin Replacement	$0
NaCl Costs	$3,000
Electrical Power Costs	$28,000
Misc. Repairs, Analytical fees, Etc.	$10,000
Secondary Waste Treatment	$10,000
Opinion of Annual O&M Cost	**$96,000**
O&M Cost /MG (Annual Production = 263 MGY)	**$365**

OPTION 5

For comparison, the capital cost and O&M costs were developed for a Reverse Osmosis treatment system where the all residual wastes are discharged to the river and is shown in Table VII-7. This option assumes that the system will be operated such that no Licenses or permits will be required by the NRC or EPA other than a NPDES permit. Total annual concentrate discharge is estimated to be 49,275,000 gallons. A conceptual building layout for the RO treatment option is shown on figure VII-4.

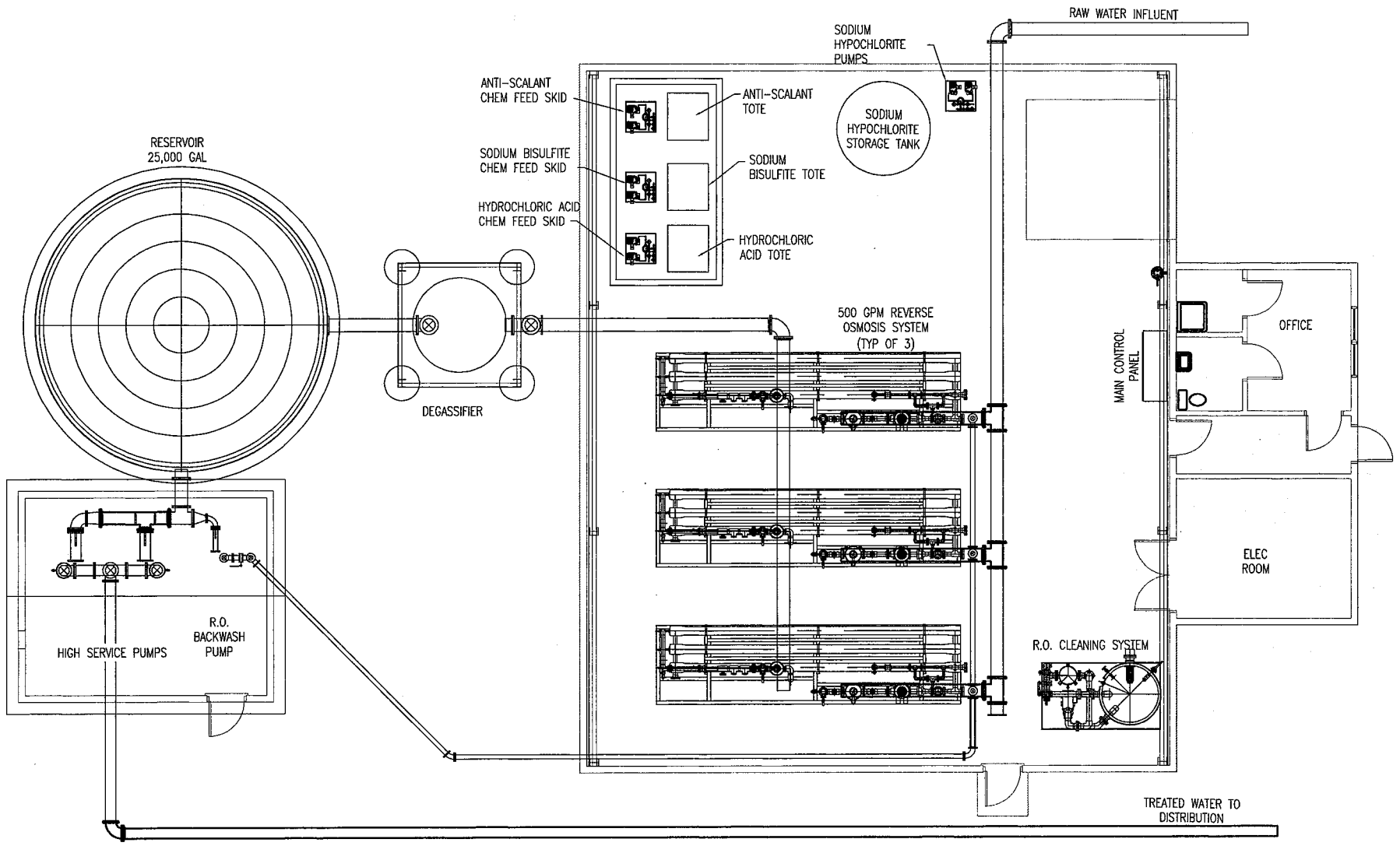

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FIGURE VII-4

Table VII-7

Conceptual Level Opinion of Capital and O&M RO (Removal of Uranium)	
	Capital
RO Equipment	$1,485,000
Sodium Hypochlorite Generator	$35,000
Decarbonators	$200,000
Building to House Equipment	$190,000
Clearwell	$500,000
Pumping Equipment	$150,000
Chemical Feed	$95,000
Power and Lighting	$125,000
HVAC	$75,000
Sanitary Sewer	$10,000
Instrumentation and Controls	$70,000
Sewer to the River	$80,000
Subtotal-Construction	**$3,015,000**
Engineering and Contingencies (15% Engineer & 20% Contingencies)	$1,055,250
Opinion of Capital Cost	**$4,070,250**
	O&M Cost
RO Plant Operation	$45,000
RO Membrane Replacement	$64,680
RO System Chemical Costs	$60,550
Electrical Power Costs	$85,000
Misc. Repairs, Analytical fees, Etc.	$10,000
Opinion of Annual O&M Cost	**$265,230**
O&M Cost (Annual Production = 263 MGY)	**$1,008**

4. **Summary**

Table VII-8 is a summary of the capital cost and annual O&M costs of each of the municipal treatment technologies discussed in this Section. Table VII-8 also includes the present worth value of the capital and operating cost of each treatment option.

Table VII-8

SUMMARY OF MUNICIPAL TREATMENT ALTERNATIVES ONLY			
Treatment Process	*Capital Cost*	*O&M Cost*	*20 Year Present Worth 1*
IX (contracted Media Disposal)	$2,079,000	$626,950	$9,270,000
IX (City does Media Disposal)	$1,464,750	$2,117,500	$25,752,000
IX (Onsite Regeneration & Haul Off Brine)	$1,755,000	$101,120	$2,915,000
IX (Onsite Regeneration & Discharge to River)	$1,734,750	$96,000	$2,836,000
RO (Removal of Uranium)	$4,070,250	$265,230	$7,112,000

The recommended process for municipal treatment is a IX with on-site regeneration. The 20 year present worth analysis suggests that brine waste disposal hauled to a uranium recovery mill or treated and discharge to the river is both feasible alternatives. Therefore, both alternatives will be further evaluated in the design phase.

To confirm the recommendation a pilot test should be conducted to determine the following:

- Cost of operation
- Ease of operation
- Stability of the process
- Chemical usage
- Waste brine characteristics and volume
- Time between regenerations

It is also recommended the City begin negotiation with Crow Butte Resources, Inc. to develop a long term agreement to take the brine waste.

VIII. ECONOMIC EVALUATION SUMMARY & RECOMMENDED ALTERNATIVE

Based on an economic evaluation the most cost effective conceptual alternative is a centralized well field and ion exchange treatment. The following five (5) treatment approaches were evaluated in detail to determine the most cost effective approach. Although ion exchange has been the apparent front runner through out the study, the disposal of process brine contaminated with uranium presents unique challenges. Therefore, the reverse osmosis process has continually been evaluated along with ion exchange.

It is also important to remember that distribution system improvements are necessary to ensure that all areas of town receive an adequate supply and pressure. Fairly significant changes to the distribution system are needed to facilitate flow from the single treatment location.

Treatment Approaches

Description	Additional Cost Per Account Month No Grant
Ion Exchange with Onsite Regeneration & Offsite Brine Disposal	$68.37
Ion Exchange with Onsite Regeneration and Disposal to River	$67.89
Reverse Osmosis with Disposal in the River	$107.94
Ion Exchange with Contract Media Disposal	$128.78
Ion Exchange with City Responsible for Media Disposal	$292.44

The 20 year present worth analysis suggests that brine waste disposal hauled to a uranium recovery mill or treated and discharge to the river is both feasible alternatives. Therefore, both alternatives will be further evaluated in the design phase.

The costs presented are based on total project as presented in the following detailed cost estimate. Included debt retirement is based on 6.0% for 20 years. Depreciation or capital item replacement costs are not included.

DETAILED CONCEPTUAL COST ESTIMATES

Detailed costs are provided for the following five (5) treatment approaches. Costs include distribution system improvements needed with the centralized treatment and supply wells.

Treatment Approaches

Ion Exchange with Onsite Regeneration & Offsite Brine Disposal
Ion Exchange with Onsite Regeneration and Disposal to the River
Reverse Osmosis with Disposal in the River
Ion Exchange with Contract Media Disposal
Ion Exchange with City Responsible for Media Disposal

City of Bridgeport
ION EXCHANGE (IX)
"Onsite Regeneration & Haul Off Brine"

PHASE I IMPROVEMENTS				
Wells				
2	EA	New Wells	$230,000 / EA	$460,000
2	LS	Electrical Extensions	$10,000 / LS	$20,000
Subtotal Phase I - Well Capital Cost				**$480,000**
Raw Water Pipeline				
8" 1600	LF	- No pavement.	$40.00 / LF	$64,000
6" 750	LF	- No pavement.	$35.00 / LF	$26,250
6" 1450	LF		$57.50 / LF	$83,375
Subtotal Phase I - Raw Water Line Capital Cost				**$173,625**
Potable Water Pipeline, Pavement R&R and Appurtenances				
10" 1100	LF		$70.00 / LF	$77,000
8" 3200	LF		$60.00 / LF	$192,000
Water Meter & Installation				
760	EA		$1,000.00 / EA	$760,000
Meter Reading System				
1	LS		$50,000 / LS	$50,000
Subtotal Phase I- Potable Water Capital Cost				**$1,079,000**
Treatment Alternative				
Equipment- Includes $20K for pilot plant.				$900,000
Building				$190,000
Brine Waste Storage				$50,000
Chemical Feed				$0
Power & Lighting				$60,000
HVAC				$75,000
Instrumentation & Controls				$35,000
Sanitary Sewer				$10,000
Subtotal Phase I - Treatment Capital Cost				**$1,320,000**
TOTAL PHASE I CAPITAL COST				**$3,052,625**
PHASE II IMPROVEMENTS				
1	EA	Re-drill Park Well	$150,000 / EA	$150,000
Potable Water Pipeline, Pavement R&R and Appurtenances				
8" 3800	LF		$60.00 / LF	$228,000
Subtotal Phase II- Potable Water Capital Cost				**$378,000**

PHASE III IMPROVEMENTS				
Potable Water Pipeline, Pavement R&R and Appurtenances				
8"	3500 LF		$60.00 / LF	$210,000
Subtotal Phase III- Potable Water Capital Cost				**$210,000**
PHASE IV IMPROVEMENTS				
Potable Water Pipeline, Pavement R&R and Appurtenances				
8"	3300 LF		$60.00 / LF	$198,000
6"	1450 LF		$57.50 / LF	$83,375
Subtotal Phase IV- Potable Water Capital Cost				**$281,375**
PHASE V IMPROVEMENTS				
Potable Water Pipeline, Pavement R&R and Appurtenances				
	400	RR & Highway Bore	$200 / LF	$80,000
8"	6300 LF	- No pavement.	$40.00 / LF	$252,000
8"	1000 LF		$60.00 / LF	$60,000
Subtotal Phase III- Potable Water Capital Cost				**$392,000**
TOTAL CAPITAL COST - PHASE I-V				**$4,314,000**
Contingency			20%	$862,800
Legal, Fiscal, Admin, Engineering, Survey & Const.			15%	$647,100
Opinion of Capital Cost				**$5,823,900**

Annual Cost - Phase I through V		
(Debt Retirement, 6.0% 20 Years)		**$507,754**
Additional Operation and Maintenance Cost		
O&M Cost		$115,000
Total Annual O & M Cost		**$115,000**
		$622,754
Total Annual Water Cost		
Additional average cost per account per month*		**$68.37**
Annual Accounts Billed	9,108	
*Based on Combined Accounts	759	

City of Bridgeport
ION EXCHANGE (IX)
"Onsite Regeneration and Disposal To River"

PHASE I IMPROVEMENTS			
Wells			
2	EA	New Wells	$230,000 / EA	$460,000
~~2~~	~~LS~~	~~Electrical Extensions~~	~~$10,000 / LS~~	~~$20,000~~
Subtotal Phase I - Well Capital Cost				**$480,000**
Raw Water Pipeline			
8"	1600	LF	- No pavement.	$40.00 / LF	$64,000
6"	750	LF	- No pavement.	$35.00 / LF	$26,250
6"	1450	LF		$57.50 / LF	$83,375
Subtotal -Raw Water Line Capital Cost					**$173,625**
Potable Water Pipeline, Pavement R&R and Appurtenances			
10"	1100	LF		$70.00 / LF	$77,000
8"	3200	LF		$60.00 / LF	$192,000
Water Meter & Installation			
	760	EA		$1,000.00 / EA	$760,000
Meter Reading System			
	1	LS		$50,000 / LS	$50,000
Subtotal Phase I- Potable Water Capital Cost					**$1,079,000**
Treatment Alternative			
Equipment- Includes $20K for pilot plant.					$900,000
Building					$190,000
Equalization Tank					$50,000
Chemical Feed					$0
Power & Lighting					$60,000
HVAC					$75,000
Instrumentation & Controls					$35,000
Sanitary Sewer & Dilution Well					$15,000
Subtotal Phase I - Treatment Capital Cost					**$1,325,000**
TOTAL PHASE I CAPITAL COST					**$3,057,625**
PHASE II IMPROVEMENTS			
	1	EA	Re-drill Park Well	$150,000 / EA	$150,000
Potable Water Pipeline, Pavement R&R and Appurtenances			
8"	3800	LF		$60.00 / LF	$228,000
Subtotal Phase II- Potable Water Capital Cost					**$378,000**

PHASE III IMPROVEMENTS				
Potable Water Pipeline, Pavement R&R and Appurtenances				
8"	3500 LF		$60.00 / LF	$210,000
	Subtotal Phase III- Potable Water Capital Cost			**$210,000**
PHASE IV IMPROVEMENTS				
Potable Water Pipeline, Pavement R&R and Appurtenances				
8"	3300 LF		$60.00 / LF	$198,000
6"	1450 LF		$57.50 / LF	$83,375
	Subtotal Phase IV- Potable Water Capital Cost			**$281,375**
PHASE V IMPROVEMENTS				
Potable Water Pipeline, Pavement R&R and Appurtenances				
	400	RR & Highway Bore	$200 / LF	$80,000
8"	6300 LF	- No pavement.	$40.00 / LF	$252,000
8"	1000 LF		$60.00 / LF	$60,000
	Subtotal Phase III- Potable Water Capital Cost			**$392,000**
	Total Capital Cost			**$4,319,000**
	Contingency		20%	$863,800
	Legal, Fiscal, Admin, Engineering, Survey & Const.		15%	$647,850
	Opinion of Capital Cost			**$5,830,650**
	Annual Cost - Phase I through V			
	(Debt Retirement, 6.0% 20 Years)			**$508,343**
	Additional Operation and Maintenance Cost			
	O&M Cost			$110,000
	Total Annual O & M Cost			**$110,000**
				$618,343
	Total Annual Water Cost			
	Additional average cost per account per month*			**$67.89**
	Annual Accounts Billed	9,108		
	*Based on Combined Accounts	759		

City of Bridgeport
REVERSE OSMOSIS (RO)

PHASE I IMPROVEMENTS			
Wells			
2 EA	New Wells	$230,000 / EA	$460,000
2 LS	Electrical Extensions	$10,000 / LS	$20,000
Subtotal Phase I - Well Capital Cost			**$480,000**
Raw Water Pipeline			
8" 1600 LF	- No pavement.	$40.00 / LF	$64,000
6" 750 LF	- No pavement.	$35.00 / LF	$26,250
6" 1450 LF		$57.50 / LF	$83,375
Subtotal -Raw Water Line Capital Cost			**$173,625**
Potable Water Pipeline, Pavement R&R and Appurtenances			
10" 1100 LF		$70.00 / LF	$77,000
8" 3200 LF		$60.00 / LF	$192,000
Water Meter & Installation			
760 EA		$1,000.00 / EA	$760,000
Meter Reading System			
1 LS		$50,000 / LS	$50,000
Subtotal Phase I- Potable Water Capital Cost			**$1,079,000**
Treatment Alternative			
RO Equipment- Includes $20K for pilot plant.			$1,505,000
Sodium Hyprochlorite Generator ($35k) & Decarbonators ($200k)			$235,000
Building			$190,000
Chemical Feed ($95k), Clearwell ($500k) & Pumping Equipment ($150l			$745,000
Power & Lighting			$125,000
HVAC			$60,000
Instrumentation & Controls			$70,000
Sanitary Sewer & River Discharge			$90,000
Subtotal Phase I - Treatment Capital Cost			**$3,020,000**
TOTAL PHASE I CAPITAL COST			**$4,752,625**
PHASE II IMPROVEMENTS			
1 EA	Re-drill Park Well	$150,000 / EA	$150,000
Potable Water Pipeline, Pavement R&R and Appurtenances			
8" 3800 LF		$60.00 / LF	$228,000
Subtotal Phase II- Potable Water Capital Cost			**$378,000**

PHASE III IMPROVEMENTS				
Potable Water Pipeline, Pavement R&R and Appurtenances				
8"	3500 LF		$60.00 / LF	$210,000
Subtotal Phase III- Potable Water Capital Cost				**$210,000**
PHASE IV IMPROVEMENTS				
Potable Water Pipeline, Pavement R&R and Appurtenances				
8"	3300 LF		$60.00 / LF	$198,000
6"	1450 LF		$57.50 / LF	$83,375
Subtotal Phase IV- Potable Water Capital Cost				**$281,375**
PHASE V IMPROVEMENTS				
Potable Water Pipeline, Pavement R&R and Appurtenances				
	400	RR & Highway Bore	$200 / LF	$80,000
8"	6300 LF	- No pavement.	$40.00 / LF	$252,000
8"	1000 LF		$60.00 / LF	$60,000
Subtotal Phase III- Potable Water Capital Cost				**$392,000**
Total Capital Cost				**$6,014,000**
Contingency			20%	$1,202,800
Legal, Fiscal, Admin, Engineering, Survey & Const.			15%	$902,100
Opinion of Capital Cost				**$8,118,900**

Annual Cost - Phase I through V		
(Debt Retirement, 6.0% 20 Years)		**$707,843**
Additional Operation and Maintenance Cost		
O&M Cost		$275,230
Total Annual O & M Cost		**$275,230**
		$983,073
Total Annual Water Cost		
Additional average cost per account per month*		**$107.94**
Annual Accounts Billed	9,108	
*Based on Combined Accounts	759	

City of Bridgeport
ION EXCHANGE (IX)
"Contracted Media Disposal"

PHASE I IMPROVEMENTS				
Wells				
2	EA	New Wells	$230,000 / EA	$460,000
2	LS	Electrical Extensions	$10,000 / LS	$20,000
Subtotal Phase I - Well Capital Cost				**$480,000**
Raw Water Pipeline				
8"	1600	LF - No pavement.	$40.00 / LF	$64,000
6"	750	LF - No pavement.	$35.00 / LF	$26,250
6"	1450	LF	$57.50 / LF	$83,375
Subtotal -Raw Water Line Capital Cost				**$173,625**
Potable Water Pipeline, Pavement R&R and Appurtenances				
10"	1100	LF	$70.00 / LF	$77,000
8"	3200	LF	$60.00 / LF	$192,000
Water Meter & Installation				
760	EA		$1,000.00 / EA	$760,000
Meter Reading System				
1	LS		$50,000 / LS	$50,000
Subtotal Phase I- Potable Water Capital Cost				**$1,079,000**
Treatment Alternative				
Equipment- Includes $20K for pilot plant.				$1,205,000
Building				$175,000
Brine Waste Storage				$0
Chemical Feed				$0
Power & Lighting				$60,000
HVAC				$75,000
Instrumentation & Controls				$35,000
Sanitary Sewer				$10,000
Subtotal Phase I - Treatment Capital Cost				**$1,560,000**
TOTAL PHASE I CAPITAL COST				**$3,292,625**
PHASE II IMPROVEMENTS				
1	EA	Re-drill Park Well	$150,000 / EA	$150,000
Potable Water Pipeline, Pavement R&R and Appurtenances				
8"	3800	LF	$60.00 / LF	$228,000
Subtotal Phase II- Potable Water Capital Cost				**$378,000**

PHASE III IMPROVEMENTS				
Potable Water Pipeline, Pavement R&R and Appurtenances				
8"	3500 LF		$60.00 / LF	$210,000
Subtotal Phase III- Potable Water Capital Cost				**$210,000**
PHASE IV IMPROVEMENTS				
Potable Water Pipeline, Pavement R&R and Appurtenances				
8"	3300 LF		$60.00 / LF	$198,000
6"	1450 LF		$57.50 / LF	$83,375
Subtotal Phase IV- Potable Water Capital Cost				**$281,375**
PHASE V IMPROVEMENTS				
Potable Water Pipeline, Pavement R&R and Appurtenances				
	400	RR & Highway Bore	$200 / LF	$80,000
8"	6300 LF	- No pavement.	$40.00 / LF	$252,000
8"	1000 LF		$60.00 / LF	$60,000
Subtotal Phase III- Potable Water Capital Cost				**$392,000**
Total Capital Cost				**$4,554,000**
Contingency			20%	$910,800
Legal, Fiscal, Admin, Engineering, Survey & Const.			15%	$683,100
Opinion of Capital Cost				**$6,147,900**

City of Bridgeport
ION EXCHANGE (IX)
"City Responsible For Media Disposal"

PHASE I IMPROVEMENTS

Wells				
2	EA	New Wells	$230,000 / EA	$460,000
2	LS	Electrical Extensions	$10,000 / LS	$20,000
Subtotal Phase I - Well Capital Cost				**$480,000**
Raw Water Pipeline				
8"	1600	LF - No pavement.	$40.00 / LF	$64,000
6"	750	LF - No pavement.	$35.00 / LF	$26,250
6"	1450	LF	$57.50 / LF	$83,375
Subtotal -Raw Water Line Capital Cost				**$173,625**
Potable Water Pipeline, Pavement R&R and Appurtenances				
10"	1100	LF	$70.00 / LF	$77,000
8"	3200	LF	$60.00 / LF	$192,000
Water Meter & Installation				
760	EA		$1,000.00 / EA	$760,000
Meter Reading System				
1	LS		$50,000 / LS	$50,000
Subtotal Phase I- Potable Water Capital Cost				**$1,079,000**
Treatment Alternative				
Equipment- Includes $20K for pilot plant.				$1,205,000
Building				$175,000
Brine Waste Storage				$0
Chemical Feed				$0
Power & Lighting				$60,000
HVAC				$75,000
Instrumentation & Controls				$35,000
Sanitary Sewer				$10,000
Subtotal Phase I - Treatment Capital Cost				**$1,560,000**
TOTAL PHASE I CAPITAL COST				**$3,292,625**
1	EA	Re-drill Park Well	$150,000 / EA	$150,000
Potable Water Pipeline, Pavement R&R and Appurtenances				
8"	3800	LF	$60.00 / LF	$228,000
Subtotal Phase II- Potable Water Capital Cost				**$378,000**

Potable Water Pipeline, Pavement R&R and Appurtenances				
8"	3500 LF		$60.00 / LF	$210,000
Subtotal Phase III- Potable Water Capital Cost				**$210,000**

Potable Water Pipeline, Pavement R&R and Appurtenances				
8"	3300 LF		$60.00 / LF	$198,000
6"	1450 LF		$57.50 / LF	$83,375
Subtotal Phase IV- Potable Water Capital Cost				**$281,375**

Potable Water Pipeline, Pavement R&R and Appurtenances				
	400	RR & Highway Bore	$200 / LF	$80,000
8"	6300 LF	- No pavement.	$40.00 / LF	$252,000
8"	1000 LF		$60.00 / LF	$60,000
Subtotal Phase III- Potable Water Capital Cost				**$392,000**

Total Capital Cost		**$4,554,000**
Contingency	20%	$910,800
Legal, Fiscal, Admin, Engineering, Survey & Const.	15%	$683,100
Opinion of Capital Cost		**$6,147,900**

IX. FINANCING

Revenues

The table below lists the total revenue from water sales for the FY2003 – FY2005.

Revenue – Water Sales

Year	Amount
FY 2003	$170,986
FY 2004	$171,227
FY 2005	$177,112
3-Yr Average =	$173,108

In order to receive RD loan monies, a minimum monthly bill of approximately $35 per month is required. If this monthly rate was applied to 759 total services (although commercial rates would most likely be proportionately higher) the annual revenue generated would equal approximately $319,000, or approximately $142,000 greater than the FY 2005 revenue. A portion of this amount could be dedicated to retiring any assumed debt for the selected improvements.

Rates

The current water system has approximately 759 total services. Of this total, 733 are charged at a residential rate of $22 per month. The remaining 26 taps are charged at individually determined rates varying from $40 to $123 per month. Due to the fact that metered water use information is not available, monthly water rates for commercial users have been established on an individual account basis. City personnel estimated that approximately 590 services provide water to residential dwellings. The remainder of the residential-rate accounts, or approximately 143 taps, serve non-residential business uses, most likely representing retail or similar low water users.

With the installation of water meters the City will have the opportunity to consider different rate models. A flow or usage based rate schedule is common. The model typically includes a base rate component with one or two flow based components. The base component is a set quantity and dollar amount. For this analysis, 8,000 gallons per

customer month was allocated for the base component. This amount was estimated from the average water pumped during the months of November, December, January and February. This value can be used to estimate the needs of residences and businesses without the influence of outside water uses like lawn irrigation. Although preliminary, estimates were made to establish a residential/business demand and a commercial demand. It is estimated that 733 residential/business customers use approximately 24,320 gallons per customer month and 26 commercial accounts use approximately 63,839 gallons per customer month. To simplify the rate model, the same base allocation is used for the two categories. The base rate establishes a minimum charge and typically ranges between $15 and $25 per customer month. To further clarify, a customers will be assessed the minimum charge whether they use 0 or 8,000 gallons.

The first flow based component allocates an additional 32,000 gallons per customer month. This quantity should provide adequate water for the average residential outdoors use. Although there is an allocated amount the customer will only be charge for actual usage. The second flow based rate component starts at 40,000 gallons and will be billed as a surcharge. The rate is 10% higher than the first flow based rate.

Only the residential/business category would be assessed the second flow based component. The commercial category would use the base rate component with an allocation and the first flow based component. Although there are no reported rural customers, residential/business or commercial, a rate has been included to cover any future requests. Typically, 10% is added to the rates for out of town service.

This type of rate model is commonly used when large capital expenditures are anticipated. It is not uncommon to see usage decrease, at least for a period of time, when rates are increase. A higher fixed base rate helps ensure that adequate revenues are generated during these transitional periods to meet financial obligations. The allocation included with the base component is normally more customer friendly. The two of flow based rate blocks does not penalize outside uses, but does promote conservation.

A summary comparison of two different rates is provided in the following table.

Customers		Gallons Base Rate Allowance 8,000 For	Gallons Flow Block 1 Next 32,000 Per 1000 gal.	Flow Block 2 Surcharge Per 1000 gal.	Total Dollars Generated: Gallons Base Rate 8,000 For	Gallons Flow Block 1 Next 32,000 Per 1000 gal.	Flow Block 2 > 40,000 Per 1000 gal.	TOTAL ANNUAL REVENUE	Average Cost Customer Month
Residential/Business	733	$12.00	$0.60	$0.66	$105,552	$71,346	$16,422	**$193,321**	**$21.98**
Residential - Rural	0	$13.20	$0.66	$0.73					
Commercial	26	$12.00	$0.60		$3,744	$10,453		**$14,197**	**$45.50**
Commercial - Rural		$13.20	$0.66						
					$109,296	**$81,799**	**$16,422**	**207,518**	

Customers	No.	Gallons Base Rate Allowance 8,000 For	Gallons Flow Block 1 Next 32,000 Per 1000 gal.	Surcharge Flow Block 2 Per 1000 gal.	Total Dollars Generated: Gallons Base Rate 8,000 For	Gallons Flow Block 1 Next 32,000 Per 1000 gal.	Surcharge Flow Block 2 > 40,000 Per 1000 gal.	TOTAL ANNUAL REVENUE	Average Cost Customer Month
Residential/Business	733	$21.60	$1.08	$1.19	$189,994	$128,424	$29,560	**$347,977**	**$39.56**
Residential - Rural	0	$23.76	$1.19	$1.31					
Commercial	26	$21.60	$1.08		$6,739	$18,815		**$25,555**	**$81.91**
Commercial - Rural		$23.76	$1.19						
					$196,733	**$147,239**	**$29,560**	**$373,532**	

X. IMPLEMENTATION SCHEDULE

The City of Bridgeport must respond to the Administrative Order and move forward with improvements to the City water system to provide quality drinking water. The steps required and timetable for completion of the improvements are given in the following tabulation.

EVENT	DATE
Submit "Report" for agency review and funding	August 2007
Start design	December 2007
Bid	July 2008
Start construction	August 2008
Final completion	August 2009

Appendix C

Hydraulic Analysis Reports for Proposed Improvements

PROPOSED - JUNCTION REPORT

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
J100	8.28	3,664.00	3,821.82	68.38
J102	8.28	3,664.00	3,822.49	68.67
J104	8.28	3,664.00	3,822.53	68.69
J106	8.28	3,664.00	3,822.61	68.73
J108	8.28	3,664.00	3,821.13	68.08
J110	8.28	3,664.00	3,821.12	68.08
J114	8.28	3,661.00	3,821.79	69.67
J116	8.28	3,661.00	3,821.76	69.66
J118	8.28	3,661.00	3,822.33	69.91
J120	8.28	3,661.00	3,823.72	70.51
J122	8.28	3,661.00	3,823.75	70.52
J124	8.28	3,661.00	3,823.72	70.51
J132	8.28	3,662.00	3,823.50	69.98
J134	8.28	3,662.00	3,823.50	69.98
J136	8.28	3,662.00	3,823.57	70.01
J138	8.28	3,661.00	3,823.65	70.47
J140	8.28	3,659.00	3,823.79	71.40
J142	8.28	3,659.00	3,823.77	71.40
J144	8.28	3,659.00	3,824.03	71.51
J146	8.28	3,661.00	3,823.75	70.52
J148	8.28	3,661.00	3,823.62	70.47
J150	8.28	3,661.00	3,822.66	70.05
J152	8.28	3,661.00	3,822.90	70.15
J154	8.28	3,659.00	3,824.86	71.87
J156	8.28	3,659.00	3,826.06	72.39
J158	8.28	3,659.00	3,825.01	71.93
J160	8.28	3,660.00	3,823.45	70.82
J162	8.28	3,662.00	3,822.33	69.47
J164	8.28	3,661.00	3,821.99	69.76
J166	8.28	3,662.00	3,821.59	69.15
J168	8.28	3,661.00	3,822.00	69.76
J170	8.28	3,660.00	3,822.43	70.38
J172	8.28	3,662.00	3,821.44	69.08
J174	8.28	3,661.00	3,821.85	69.69
J176	8.28	3,660.00	3,822.38	70.36
J178	8.28	3,660.00	3,821.43	69.95
J180	8.28	3,661.00	3,821.29	69.45
J182	8.28	3,662.00	3,821.12	68.95
J184	8.28	3,662.00	3,820.90	68.85
J186	8.28	3,661.00	3,820.98	69.32
J188	8.28	3,660.00	3,821.20	69.85
J190	8.28	3,662.00	3,820.84	68.83

PROPOSED - JUNCTION REPORT

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
J192	8.28	3,661.00	3,820.87	69.27
J194	8.28	3,660.00	3,820.99	69.76
J196	8.28	3,661.00	3,820.84	69.26
J198	8.28	3,660.00	3,820.86	69.70
J20	8.28	3,671.00	3,777.03	45.94
J200	8.28	3,660.00	3,820.84	69.69
J202	8.28	3,660.00	3,820.84	69.69
J204	8.28	3,660.00	3,820.84	69.69
J206	8.28	3,660.00	3,820.84	69.69
J208	8.28	3,660.00	3,820.86	69.70
J210	8.28	3,660.00	3,820.85	69.70
J212	34.04	3,660.00	3,820.87	69.71
J214	8.28	3,656.00	3,820.88	71.44
J216	8.28	3,656.00	3,820.88	71.44
J218	8.28	3,648.00	3,820.86	74.90
J22	8.28	3,671.00	3,767.93	42.00
J220	8.28	3,655.00	3,820.85	71.86
J222	8.28	3,655.00	3,820.86	71.87
J224	8.28	3,655.00	3,820.85	71.86
J226	8.28	3,648.00	3,820.85	74.90
J228	8.28	3,660.00	3,821.02	69.77
J230	8.28	3,660.00	3,821.03	69.77
J232	8.28	3,659.00	3,820.95	70.17
J234	8.28	3,658.00	3,820.93	70.60
J236	8.28	3,658.00	3,820.93	70.60
J238	8.28	3,658.00	3,820.94	70.60
J24	1,000.00	3,671.00	3,757.76	37.59
J240	8.28	3,658.00	3,820.94	70.60
J242	8.28	3,659.00	3,821.03	70.21
J244	8.28	3,660.00	3,821.24	69.86
J246	8.28	3,660.00	3,821.26	69.87
J248	8.28	3,660.00	3,822.06	70.22
J250	8.28	3,660.00	3,821.52	69.99
J252	8.28	3,659.00	3,821.13	70.25
J254	8.28	3,658.00	3,820.98	70.62
J256	8.28	3,658.00	3,820.95	70.61
J258	8.28	3,657.00	3,821.18	71.14
J26	8.28	3,671.00	3,775.22	45.16
J260	8.28	3,658.00	3,821.24	70.73
J262	8.28	3,658.00	3,821.21	70.72
J264	8.28	3,660.00	3,821.68	70.06
J266	8.28	3,660.00	3,821.82	70.12

PROPOSED - JUNCTION REPORT

	ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
	J268	34.04	3,660.00	3,823.14	70.69
	J274	8.28	3,660.00	3,823.15	70.69
	J276	8.28	3,660.00	3,823.15	70.69
	J278	8.28	3,660.00	3,824.07	71.09
	J28	8.28	3,669.00	3,806.93	59.76
	J280	8.28	3,659.00	3,821.52	70.42
	J282	8.28	3,659.00	3,821.52	70.42
	J284	8.28	3,658.00	3,820.39	70.36
	J286	34.04	3,655.00	3,820.19	71.58
	J288	8.28	3,659.00	3,824.99	71.92
	J290	8.28	3,665.00	3,821.11	67.64
	J292	8.28	3,664.00	3,821.07	68.06
	J294	8.28	3,664.00	3,821.93	68.43
	J296	8.28	3,665.00	3,821.18	67.67
	J298	8.28	3,665.00	3,821.01	67.60
	J300	8.28	3,665.00	3,820.62	67.43
	J302	8.28	3,665.00	3,820.77	67.50
	J304	8.28	3,665.00	3,820.98	67.59
	J306	8.28	3,665.00	3,821.03	67.61
	J308	8.28	3,664.00	3,821.05	68.05
	J310	8.28	3,664.00	3,821.60	68.29
	J312	8.28	3,665.00	3,820.95	67.57
	J314	8.28	3,665.00	3,821.02	67.60
	J316	8.28	3,664.00	3,821.05	68.05
	J318	8.28	3,664.00	3,821.33	68.17
	J32	8.28	3,669.00	3,820.50	65.64
	J320	8.28	3,666.00	3,820.97	67.15
	J322	8.28	3,665.00	3,821.01	67.60
	J324	8.28	3,664.00	3,821.08	68.06
	J326	8.28	3,664.00	3,821.12	68.08
	J330	8.28	3,665.00	3,821.01	67.60
	J336	8.28	3,665.00	3,821.01	67.60
	J338	8.28	3,665.00	3,821.00	67.60
	J34	8.28	3,668.00	3,819.01	65.43
	J340	8.28	3,665.00	3,821.03	67.61
	J342	8.28	3,664.00	3,821.07	68.06
	J344	8.28	3,664.00	3,821.11	68.07
	J346	8.28	3,668.00	3,821.03	66.31
	J348	8.28	3,664.00	3,821.02	68.04
	J350	8.28	3,664.00	3,821.03	68.04
	J352	8.28	3,664.00	3,821.03	68.04
	J354	8.28	3,664.00	3,820.96	68.01

PROPOSED - JUNCTION REPORT

	ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
1	J356	8.28	3,665.00	3,820.91	67.56
2	J358	8.28	3,665.00	3,820.86	67.54
3	J36	8.28	3,668.00	3,818.60	65.26
4	J360	8.28	3,664.00	3,820.83	67.96
5	J362	8.28	3,665.00	3,820.82	67.52
6	J364	8.28	3,664.00	3,820.78	67.93
7	J366	8.28	3,665.00	3,820.82	67.51
8	J368	8.28	3,665.00	3,820.81	67.51
9	J370	8.28	3,665.00	3,820.74	67.48
10	J372	8.28	3,665.00	3,820.55	67.40
11	J374	8.28	3,665.00	3,820.52	67.39
12	J376	8.28	3,665.00	3,820.81	67.51
13	J378	8.28	3,665.00	3,820.99	67.59
14	J38	8.28	3,668.00	3,818.63	65.27
15	J386	0.00	3,665.00	3,820.84	67.52
16	J388	0.00	3,665.00	3,829.49	71.27
17	J40	8.28	3,668.00	3,818.55	65.23
18	J42	8.28	3,668.00	3,819.11	65.47
19	J44	8.28	3,665.00	3,819.44	66.92
20	J46	8.28	3,664.00	3,819.64	67.44
21	J48	8.28	3,666.00	3,819.56	66.54
22	J50	8.28	3,666.00	3,819.23	66.40
23	J52	8.28	3,666.00	3,819.41	66.47
24	J54	8.28	3,664.00	3,819.87	67.54
25	J56	8.28	3,661.00	3,820.23	68.99
26	J58	8.28	3,663.00	3,820.23	68.13
27	J60	8.28	3,666.00	3,819.43	66.48
28	J62	8.28	3,666.00	3,819.51	66.52
29	J64	8.28	3,665.00	3,819.72	67.04
30	J66	8.28	3,667.00	3,819.03	65.88
31	J68	8.28	3,668.00	3,818.79	65.34
32	J70	8.28	3,665.00	3,820.06	67.19
33	J72	8.28	3,665.00	3,820.44	67.35
34	J74	8.28	3,665.00	3,820.45	67.36
35	J76	8.28	3,665.00	3,820.45	67.36
36	J78	8.28	3,665.00	3,820.49	67.37
37	J80	8.28	3,665.00	3,820.71	67.47
38	J82	8.28	3,663.00	3,820.60	68.29
39	J84	8.28	3,662.00	3,820.97	68.88
40	J86	8.28	3,662.00	3,821.01	68.90
41	J88	8.28	3,661.00	3,821.31	69.46
42	J90	8.28	3,665.00	3,821.01	67.60

PROPOSED - JUNCTION REPORT

	ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
	J92	8.28	3,665.00	3,821.26	67.71
	J94	8.28	3,665.00	3,821.26	67.71
	J96	8.28	3,665.00	3,821.26	67.71
	J98	8.28	3,665.00	3,821.22	67.69

PROPOSED - PIPE REPORT

	ID	From Node	To Node	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/kft)
1	P101	J96	J100	198.36	8.00	130.00	-366.38	2.34	0.56	2.84
2	P103	J96	J98	48.60	8.00	130.00	171.63	1.10	0.03	0.70
3	P105	J98	J108	298.80	6.00	100.00	40.02	0.45	0.09	0.31
4	P107	J100	J116	526.99	4.00	100.00	8.28	0.21	0.06	0.12
5	P109	J100	J102	216.88	8.00	130.00	-382.94	2.44	0.67	3.09
6	P111	J108	J110	74.70	6.00	100.00	31.74	0.36	0.02	0.20
7	P113	J102	J104	14.06	10.00	100.00	-471.20	1.92	0.03	2.48
8	P115	J104	J106	32.58	10.00	100.00	-479.48	1.96	0.08	2.56
9	P117	J106	J132	335.90	10.00	100.00	-487.76	1.99	0.89	2.65
10	P119	J102	J294	505.04	6.00	100.00	79.98	0.91	0.57	1.12
11	P121	J110	J292	405.91	6.00	100.00	23.46	0.27	0.05	0.12
12	P123	J294	J310	360.51	6.00	100.00	71.70	0.81	0.33	0.92
13	P125	J292	J308	362.28	6.00	100.00	15.18	0.17	0.02	0.05
14	P129	J310	J318	367.36	6.00	100.00	63.42	0.72	0.27	0.73
15	P13	J20	J22	289.17	6.00	100.00	484.15	5.49	9.10	31.46
16	P131	J308	J316	367.36	6.00	100.00	6.90	0.08	0.00	0.01
17	P133	J318	J326	368.23	6.00	100.00	55.14	0.63	0.21	0.56
18	P135	J316	J324	368.23	6.00	100.00	-19.77	0.22	0.03	0.08
19	P137	J316	J314	355.27	6.00	100.00	18.39	0.21	0.03	0.07
20	P139	J72	J74	343.78	6.00	100.00	-8.28	0.09	0.01	0.02
21	P141	J76	J74	38.79	6.00	100.00	-14.67	0.17	0.00	0.05
22	P143	J74	J78	210.44	6.00	100.00	-31.23	0.35	0.04	0.20
23	P145	J78	J300	421.27	6.00	100.00	-39.51	0.45	0.13	0.30
24	P147	J300	J302	355.14	6.00	100.00	-47.79	0.54	0.15	0.43
25	P149	J302	J304	357.22	6.00	100.00	-56.07	0.64	0.21	0.58
26	P15	J22	J24	333.73	6.00	100.00	475.87	5.40	10.17	30.47
27	P151	J296	J298	427.34	4.00	100.00	15.59	0.40	0.17	0.39
28	P153	J298	J304	359.05	4.00	100.00	7.31	0.19	0.03	0.10
29	P155	J304	J306	357.22	8.00	100.00	-57.04	0.36	0.05	0.15
30	P157	J296	J98	358.28	6.00	100.00	-23.87	0.27	0.04	0.12
31	P159	J98	J290	446.58	8.00	130.00	99.47	0.63	0.11	0.25
32	P161	J290	J306	360.70	8.00	130.00	91.19	0.58	0.08	0.22
33	P163	J306	J314	367.36	8.00	100.00	25.87	0.17	0.01	0.03
34	P165	J314	J322	365.46	8.00	100.00	19.42	0.12	0.01	0.02
35	P167	J322	J330	84.87	8.00	100.00	32.92	0.21	0.00	0.05
36	P169	J320	J322	359.17	4.00	100.00	-8.28	0.21	0.04	0.12
37	P17	J24	J26	276.91	4.00	100.00	-242.56	6.19	17.46	63.05
38	P171	J322	J324	352.43	6.00	100.00	-30.06	0.34	0.06	0.18
39	P173	J324	J326	57.55	6.00	100.00	-64.58	0.73	0.04	0.75
40	P175	J326	J166	362.87	4.00	100.00	-29.92	0.76	0.47	1.31
41	P177	J324	J342	362.46	6.00	100.00	6.47	0.07	0.00	0.01
42	P179	J326	J344	362.46	6.00	100.00	12.20	0.14	0.01	0.03

PROPOSED - PIPE REPORT

ID	From Node	To Node	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/kft)
P181	J330	J336	52.03	8.00	100.00	24.64	0.16	0.00	0.03
P183	J336	J340	226.67	8.00	100.00	-44.60	0.28	0.02	0.09
P185	J336	J338	82.50	10.00	100.00	60.96	0.25	0.00	0.06
P187	J340	J342	355.30	8.00	100.00	-52.88	0.34	0.05	0.13
P189	J342	J344	57.13	8.00	100.00	-122.60	0.78	0.03	0.61
P19	J26	J40	645.85	4.00	100.00	-250.84	6.40	43.33	67.09
P191	J344	J172	361.89	8.00	100.00	-152.71	0.97	0.33	0.91
P193	J166	J172	361.21	4.00	100.00	16.46	0.42	0.16	0.43
P195	J342	J346	353.68	8.00	130.00	67.92	0.43	0.04	0.13
P197	J344	J350	353.68	6.00	100.00	34.02	0.39	0.08	0.23
P199	J346	J348	44.88	8.00	130.00	59.64	0.38	0.00	0.10
P201	J350	J348	11.69	6.00	100.00	30.22	0.34	0.00	0.19
P203	J350	J352	7.75	4.00	100.00	-4.48	0.11	0.000	0.03
P205	J352	J182	361.57	4.00	100.00	-12.76	0.33	0.10	0.27
P207	J348	J354	376.73	8.00	130.00	81.58	0.52	0.07	0.18
P209	J354	J356	305.03	8.00	130.00	73.30	0.47	0.04	0.14
P21	J24	J28	591.64	4.00	100.00	-281.57	7.19	49.17	83.10
P211	J172	J182	362.48	4.00	100.00	23.98	0.61	0.31	0.87
P213	J172	J174	371.36	8.00	100.00	-168.51	1.08	0.41	1.10
P215	J166	J168	370.04	4.00	100.00	-27.35	0.70	0.41	1.11
P217	J168	J174	363.83	4.00	100.00	16.52	0.42	0.16	0.44
P219	J168	J170	375.29	4.00	100.00	-27.71	0.71	0.43	1.13
P221	J170	J176	363.83	4.00	100.00	9.25	0.24	0.05	0.15
P223	J174	J176	375.29	8.00	100.00	-193.10	1.23	0.53	1.41
P225	J176	J178	358.54	4.00	100.00	43.70	1.12	0.95	2.64
P227	J178	J180	375.29	4.00	100.00	15.39	0.39	0.14	0.38
P229	J180	J182	371.36	4.00	100.00	16.61	0.42	0.16	0.44
P23	J20	J28	920.85	6.00	100.00	-492.43	5.59	29.90	32.47
P231	J174	J180	359.85	4.00	100.00	32.83	0.84	0.56	1.55
P233	J182	J184	370.80	4.00	100.00	19.55	0.50	0.22	0.59
P235	J180	J186	373.42	4.00	100.00	23.33	0.60	0.31	0.82
P237	J184	J190	299.52	4.00	100.00	11.27	0.29	0.06	0.21
P239	J186	J192	298.20	4.00	100.00	15.05	0.38	0.11	0.37
P241	J178	J188	370.80	4.00	100.00	20.04	0.51	0.23	0.62
P243	J188	J194	302.14	4.00	100.00	21.45	0.55	0.21	0.71
P245	J194	J198	445.24	4.00	100.00	13.17	0.34	0.13	0.29
P247	J188	J246	381.24	4.00	100.00	-9.69	0.25	0.06	0.16
P249	J192	J196	380.96	4.00	100.00	6.77	0.17	0.03	0.08
P25	J28	J36	152.59	6.00	100.00	-782.28	8.88	11.68	76.52
P251	J246	J228	356.49	4.00	100.00	21.07	0.54	0.24	0.68
P253	J228	J230	371.29	4.00	100.00	-3.07	0.08	0.01	0.02
P255	J228	J208	393.09	4.00	100.00	15.87	0.41	0.16	0.40

PROPOSED - PIPE REPORT

ID	From Node	To Node	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/kft)
P257	J198	J208	379.91	8.00	100.00	-0.79	0.01	0.00	0.00
P259	J230	J212	391.15	6.00	100.00	45.09	0.51	0.15	0.39
P261	J212	J208	373.02	8.00	100.00	27.45	0.18	0.01	0.04
P263	J198	J200	350.72	4.00	100.00	5.67	0.14	0.02	0.06
P265	J208	J210	348.93	8.00	130.00	34.24	0.22	0.01	0.04
P267	J200	J202	450.51	6.00	100.00	-1.12	0.01	0.000	0.000
P269	J202	J204	74.81	6.00	100.00	-9.40	0.11	0.00	0.02
P27	J36	J38	54.70	8.00	100.00	-95.04	0.61	0.02	0.38
P271	J204	J206	36.73	6.00	100.00	8.28	0.09	0.000	0.02
P273	J210	J204	331.88	8.00	130.00	25.96	0.17	0.01	0.02
P275	J212	J214	371.35	8.00	100.00	-16.39	0.10	0.01	0.01
P279	J218	J226	366.51	8.00	130.00	30.28	0.19	0.01	0.03
P281	J226	J224	333.31	6.00	100.00	4.22	0.05	0.00	0.00
P283	J220	J224	363.89	6.00	100.00	4.06	0.05	0.00	0.00
P285	J218	J220	333.30	4.00	100.00	3.95	0.10	0.01	0.03
P287	J222	J220	367.29	6.00	90.00	8.39	0.10	0.01	0.02
P289	J216	J222	333.60	4.00	100.00	6.24	0.16	0.02	0.07
P29	J34	J36	21.60	8.00	100.00	780.64	4.98	0.41	18.76
P291	J214	J218	337.43	8.00	130.00	42.52	0.27	0.02	0.05
P293	J214	J216	28.89	8.00	130.00	-67.19	0.43	0.00	0.13
P295	J376	J368	776.33	8.00	130.00	9.50	0.06	0.00	0.00
P297	J368	J370	71.27	4.00	100.00	24.84	0.63	0.07	0.93
P299	J370	J372	442.50	4.00	100.00	16.56	0.42	0.19	0.44
P301	J372	J374	239.65	4.00	100.00	8.28	0.21	0.03	0.12
P303	J368	J366	380.71	8.00	130.00	-23.62	0.15	0.01	0.02
P305	J366	J362	212.25	8.00	130.00	-31.90	0.20	0.01	0.03
P307	J362	J364	314.70	4.00	100.00	8.28	0.21	0.04	0.12
P309	J360	J362	143.68	8.00	130.00	48.46	0.31	0.01	0.07
P31	J34	J32	77.64	8.00	100.00	-788.92	5.04	1.49	19.14
P311	J360	J358	343.35	8.00	130.00	-56.74	0.36	0.03	0.09
P313	J356	J358	443.61	8.00	130.00	65.02	0.41	0.05	0.12
P315	J222	J234	365.48	4.00	100.00	-10.43	0.27	0.07	0.19
P317	J232	J216	364.39	8.00	130.00	81.71	0.52	0.06	0.18
P319	J232	J234	333.54	4.00	100.00	5.73	0.15	0.02	0.06
P321	J242	J232	356.49	8.00	130.00	95.72	0.61	0.08	0.24
P323	J242	J252	369.58	8.00	130.00	-104.00	0.66	0.10	0.28
P325	J234	J236	371.30	6.00	100.00	-1.43	0.02	0.000	0.000
P327	J240	J234	354.39	6.00	100.00	11.55	0.13	0.01	0.03
P329	J240	J238	371.30	6.00	100.00	5.37	0.06	0.00	0.01
P33	J36	J40	266.94	8.00	130.00	85.12	0.54	0.05	0.19
P331	J238	J236	354.39	6.00	100.00	9.71	0.11	0.01	0.02
P333	J240	J254	333.93	6.00	100.00	-25.20	0.29	0.04	0.13

PROPOSED - PIPE REPORT

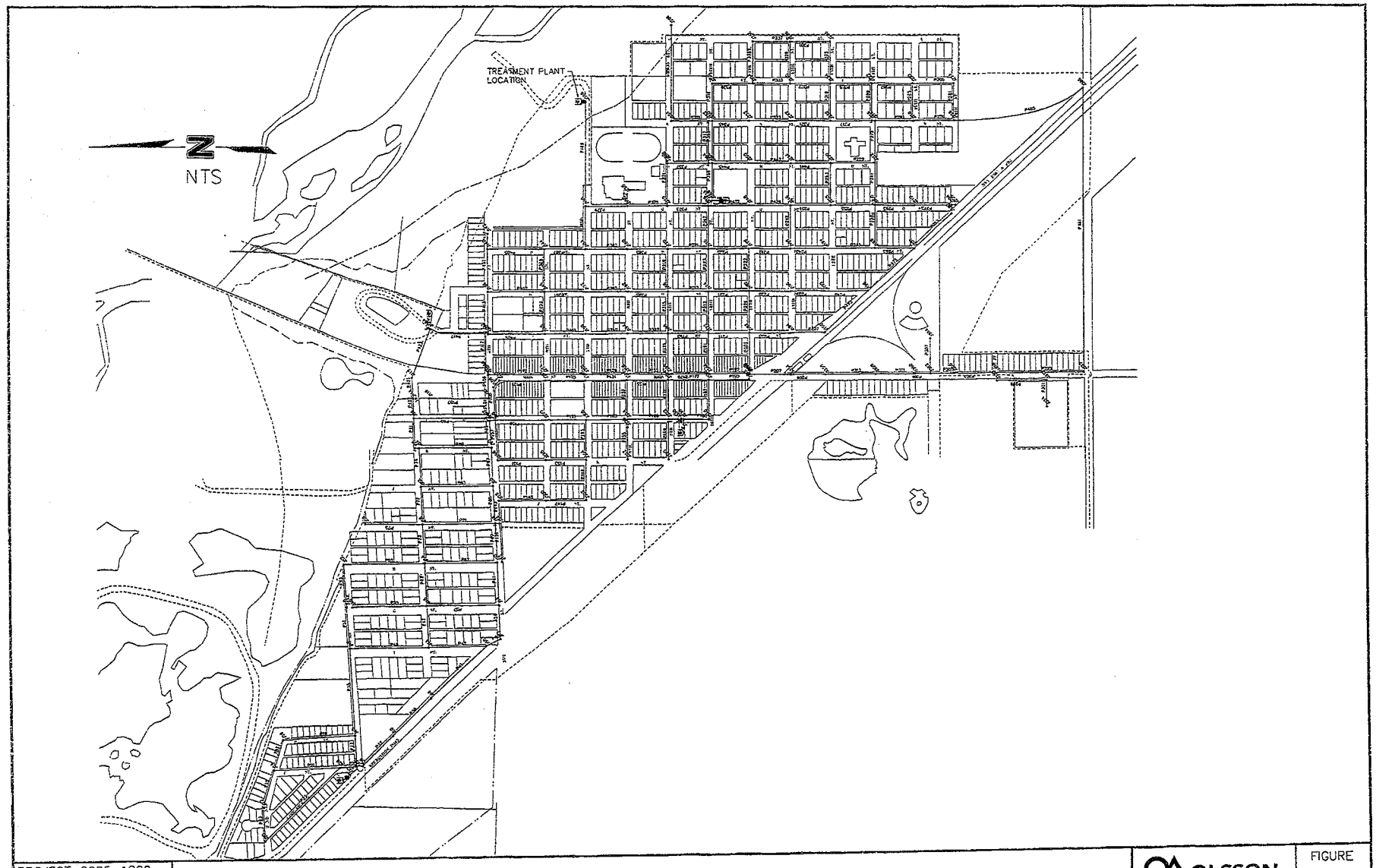
ID	From Node	To Node	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/kft)
P335	J254	J256	371.30	6.00	100.00	20.89	0.24	0.03	0.09
P337	J256	J238	333.93	6.00	100.00	12.61	0.14	0.01	0.04
P339	J254	J258	358.58	6.00	100.00	-54.38	0.62	0.20	0.55
P341	J258	J260	333.54	6.00	100.00	-62.66	0.40	0.06	0.18
P345	J260	J252	325.03	8.00	130.00	112.28	0.72	0.10	0.32
P347	J262	J264	373.27	4.00	100.00	-29.33	0.75	0.47	1.26
P349	J260	J262	33.55	4.00	100.00	21.27	0.54	0.02	0.69
P35	J40	J42	772.00	8.00	130.00	-174.00	1.11	0.55	0.72
P351	J284	J262	331.97	4.00	100.00	-42.32	1.08	0.82	2.49
P353	J260	J266	373.28	8.00	100.00	-204.48	1.31	0.59	1.57
P355	J266	J264	35.39	4.00	100.00	54.17	1.38	0.14	3.93
P357	J280	J264	367.15	4.00	100.00	-16.56	0.42	0.16	0.44
P359	J266	J268	328.14	8.00	100.00	-339.94	2.17	1.32	4.03
P361	U7002	J268	75.92	8.00	100.00	331.99	2.12	0.29	3.85
P363	J268	J274	34.64	8.00	100.00	-41.99	0.27	0.00	0.08
P365	J274	J276	45.04	8.00	100.00	-50.27	0.32	0.01	0.11
P367	J276	J176	379.38	8.00	100.00	235.84	1.51	0.78	2.05
P369	J282	J280	19.62	4.00	100.00	-8.28	0.21	0.00	0.12
P37	J38	J68	375.37	8.00	100.00	-103.32	0.66	0.17	0.44
P371	J280	V8004	354.76	4.00	100.00	0.00	0.00	0.00	0.00
P373	J278	J276	368.36	8.00	130.00	341.72	2.18	0.92	2.50
P375	J278	J158	356.51	8.00	130.00	-350.00	2.23	0.93	2.61
P377	J158	J288	101.62	4.00	100.00	8.28	0.21	0.01	0.12
P379	J158	J156	369.09	8.00	130.00	-366.56	2.34	1.05	2.85
P381	J156	J154	377.77	8.00	130.00	387.42	2.47	1.19	3.15
P383	J154	J160	367.90	4.00	100.00	53.52	1.37	1.41	3.84
P385	J160	J170	363.44	4.00	100.00	45.24	1.15	1.02	2.81
P387	J154	J144	364.64	8.00	130.00	325.63	2.08	0.83	2.29
P389	J144	J146	374.22	8.00	130.00	177.31	1.13	0.28	0.74
P39	J68	J66	469.71	8.00	100.00	-111.60	0.71	0.24	0.51
P391	J146	J152	364.64	4.00	100.00	41.00	1.05	0.85	2.34
P393	J152	J162	367.90	4.00	100.00	32.72	0.84	0.57	1.54
P395	J162	J168	362.13	4.00	100.00	24.44	0.62	0.33	0.90
P397	J166	J164	361.78	4.00	100.00	-27.31	0.70	0.40	1.10
P399	J150	J164	369.57	4.00	100.00	35.59	0.91	0.67	1.80
P401	J150	J148	362.90	4.00	100.00	-43.87	1.12	0.96	2.66
P403	J148	J146	375.04	8.00	130.00	-116.79	0.75	0.13	0.34
P405	J144	J140	595.44	8.00	130.00	140.04	0.89	0.24	0.48
P407	J146	J138	502.78	4.00	100.00	11.23	0.29	0.11	0.21
P409	J148	J136	504.64	8.00	130.00	64.65	0.41	0.06	0.11
P41	J66	J60	679.23	8.00	100.00	-119.88	0.77	0.40	0.58
P411	J134	J136	15.00	4.00	100.00	-56.37	1.44	0.06	4.23

PROPOSED - PIPE REPORT

	ID	From Node	To Node	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/kft)
1	P413	J134	J138	359.38	8.00	130.00	-126.43	0.81	0.14	0.40
2	P415	J134	J132	18.30	12.00	100.00	174.52	0.50	0.00	0.16
3	P417	J132	J122	504.78	12.00	100.00	-321.52	0.91	0.25	0.50
4	P421	J122	J120	9.91	8.00	100.00	308.03	1.97	0.03	3.38
5	P423	J120	J118	458.96	8.00	100.00	291.47	1.86	1.39	3.03
6	P425	J118	J114	187.39	8.00	100.00	283.19	1.81	0.54	2.87
7	P427	J114	J88	177.16	8.00	100.00	274.91	1.75	0.48	2.72
8	P429	J120	J124	26.53	4.00	100.00	8.28	0.21	0.00	0.12
9	P43	J60	J62	134.32	8.00	100.00	-124.71	0.80	0.08	0.63
10	P431	J138	J140	375.22	8.00	130.00	-123.48	0.79	0.14	0.38
11	P433	J140	J142	137.36	4.00	100.00	8.28	0.21	0.02	0.12
12	P435	J284	J286	851.12	6.00	100.00	34.04	0.39	0.20	0.23
13	P437	J276	J248	358.18	4.00	100.00	47.32	1.21	1.09	3.06
14	P439	J248	J246	371.68	4.00	100.00	39.04	1.00	0.80	2.14
15	P441	J230	J244	356.49	6.00	100.00	-56.45	0.64	0.21	0.59
16	P443	J244	J250	371.68	6.00	100.00	-64.73	0.73	0.28	0.76
17	P445	J250	J266	324.00	6.00	100.00	-73.01	0.83	0.31	0.95
18	P447	J338	T5000	40.69	10.00	100.00	52.68	0.22	0.00	0.04
19	P45	J60	J44	515.27	4.00	100.00	-3.45	0.09	0.01	0.02
20	P451	J314	J378	71.37	4.00	100.00	16.56	0.42	0.03	0.43
21	P455	J378	J312	285.85	4.00	100.00	8.28	0.21	0.03	0.12
22	P457	J122	T5002	136.88	12.00	100.00	-637.83	1.81	0.25	1.79
23	P459	RES9000	U7000	40.57	8.00	100.00	797.20	5.09	0.79	19.52
24	P461	U7000	J32	40.39	8.00	100.00	797.20	5.09	0.79	19.51
25	P463	RES9002	U7002	72.96	8.00	120.00	331.99	2.12	0.20	2.75
26	P465	V8004	J278	18.19	4.00	100.00	0.00	0.0000	0.00	0.00
27	P47	J44	J46	366.70	8.00	130.00	-151.60	0.97	0.20	0.56
28	P473	J190	J196	530.23	6.00	130.00	2.99	0.03	0.000	0.00
29	P475	J196	J200	560.86	6.00	130.00	1.48	0.02	0.000	0.000
30	P477	RES9004	U7004	20.00	10.00	130.00	762.26	3.11	0.07	3.72
31	P481	J376	J386	2,531.65	8.00	130.00	-17.78	0.11	0.03	0.01
32	P485	J386	J226	1,263.71	8.00	130.00	-17.78	0.11	0.01	0.01
33	P487	U7004	J388	19.31	10.00	130.00	762.26	3.11	0.07	3.72
34	P489	J156	J388	921.93	10.00	130.00	-762.26	3.11	3.44	3.73
35	P49	J44	J42	699.41	8.00	130.00	139.87	0.89	0.33	0.48
36	P51	J42	J50	364.58	6.00	100.00	-42.42	0.48	0.13	0.35
37	P53	J50	J52	375.50	6.00	100.00	-50.70	0.58	0.18	0.48
38	P55	J48	J46	661.43	4.00	100.00	-8.28	0.21	0.08	0.12
39	P57	J46	J64	640.11	4.00	100.00	-8.42	0.21	0.08	0.12
40	P59	J64	J62	298.44	8.00	100.00	132.99	0.85	0.21	0.71
41	P61	J64	J70	376.97	8.00	100.00	-149.69	0.96	0.33	0.88
42	P63	J46	J54	373.70	8.00	130.00	-159.74	1.02	0.23	0.61

PROPOSED - PIPE REPORT

	ID	From Node	To Node	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/kft)
	P65	J52	J54	720.24	6.00	100.00	-58.98	0.67	0.46	0.64
	P67	J54	J70	643.32	4.00	100.00	-13.16	0.34	0.18	0.29
	P69	J70	J76	346.23	8.00	100.00	-171.13	1.09	0.39	1.13
	P71	J76	J58	645.38	4.00	100.00	14.23	0.36	0.21	0.33
	P73	J54	J58	344.51	8.00	130.00	-213.84	1.36	0.36	1.05
	P75	J56	J58	507.45	6.00	100.00	-8.28	0.09	0.01	0.02
	P77	J58	J82	345.28	8.00	130.00	-216.17	1.38	0.37	1.07
	P79	J82	J84	341.28	8.00	130.00	-214.88	1.37	0.36	1.06
	P81	J84	J86	36.46	8.00	130.00	-216.90	1.38	0.04	1.08
	P83	J82	J80	641.29	4.00	100.00	-9.57	0.24	0.10	0.16
	P85	J76	J80	341.92	8.00	130.00	-178.97	1.14	0.26	0.75
	P87	J80	J90	340.06	8.00	130.00	-196.82	1.26	0.31	0.90
	P89	J84	J90	643.98	4.00	100.00	-6.25	0.16	0.05	0.07
	P91	J86	J88	266.40	8.00	130.00	-225.18	1.44	0.31	1.15
	P93	J88	J92	642.86	8.00	100.00	41.45	0.26	0.05	0.08
	P95	J90	J96	239.55	8.00	130.00	-211.35	1.35	0.25	1.03
	P97	J92	J94	33.96	8.00	100.00	33.17	0.21	0.00	0.05
	P99	J94	J96	13.24	8.00	100.00	24.89	0.16	0.000	0.04



PROJECT: 2005-1069 DRAWN BY: CIM DATE: 10/14/06	CITY OF BRIDGEPORT – PROPOSED SYSTEM NODE MAP	OLSSON ASSOCIATES FIGURE

Appendix F

Well Field Evaluation Data

Appendix F-1

Borehole Log and Well Construction Diagrams

OLSSON ASSOCIATES

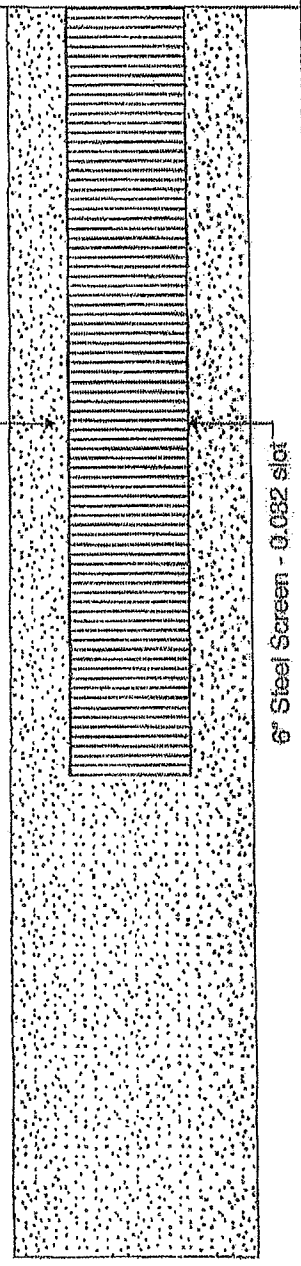
Well Number: PW-1

Project No.: 005-1069
Project: Bridgeport
Client: City of Bridgeport
Location: Bridgeport, NE
Project Manager: Jennifer Hoevet

SUBSURFACE PROFILE

Depth	Symbol	Description	Elevation (ft)
65–70		Fine to coarse sand w/ 10-15% gravel up to 1/2" diameter, tumbled brule=5%	-70.00
70–80		Fine to coarse sand (10-20%), some tumbled brule, fine to coarse gravel (up to 80%)	-80.00
80–90		Very fine to fine sand (90%) w/ tumbled brule up to 1" diameter	-90.00
90–100		Medium to coarse sand (40-60%) w/ fine sand (20%) and fine gravel (20%), tumbled brule up to 1/2" diameter	-100.00
100–105		Fine to medium sand w/ some coarse sand	-105.00
105–120		Brule	-120.00

Well Completion Details



Depth: 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120

Drill Date: 04/30/07
Total Depth: 120.00
Static Water Level: N/A
Pumping Rate: N/A
Pumping Water Level: N/A

OLSSON ASSOCIATES

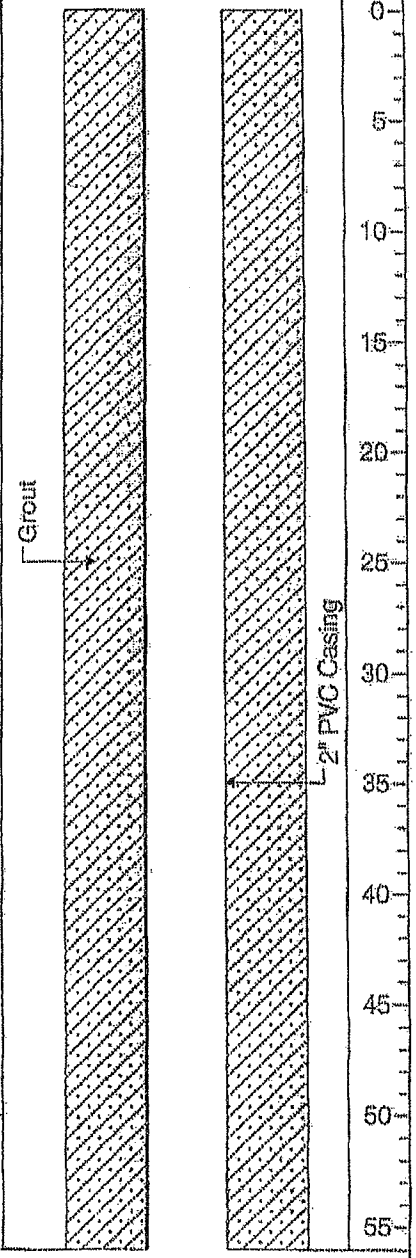
Well Number: OBS-1

Project No.: 005-1069
Project: Bridgeport
Client: City of Bridgeport
Location: Bridgeport, NE
Project Manager: Jennifer Hoevet

SUBSURFACE PROFILE

Depth	Symbol	Description	Elevation (ft)
0		Ground Surface	0.00
		Fine to medium gravel (40%) w/ fine to coarse sand (60%)	
10			-10.00
		Fine to coarse sand w/ fine gravel	
20			-20.00
		Fine to medium sand w/ coarse sand	
30			-30.00
		Medium to coarse sand w/ 20% fine sand	
40			-40.00
		Very fine to fine sand, very few larger particles	
50			-50.00
		Drill chatter at 50', fine to medium to coarse sand w/ tumbled brule	
55			

Well Completion Details



Drill Date: 04/30/07
Total Depth: 108.00
Static Water Level: N/A
Pumping Rate: N/A
Pumping Water Level: N/A

OLSSON ASSOCIATES

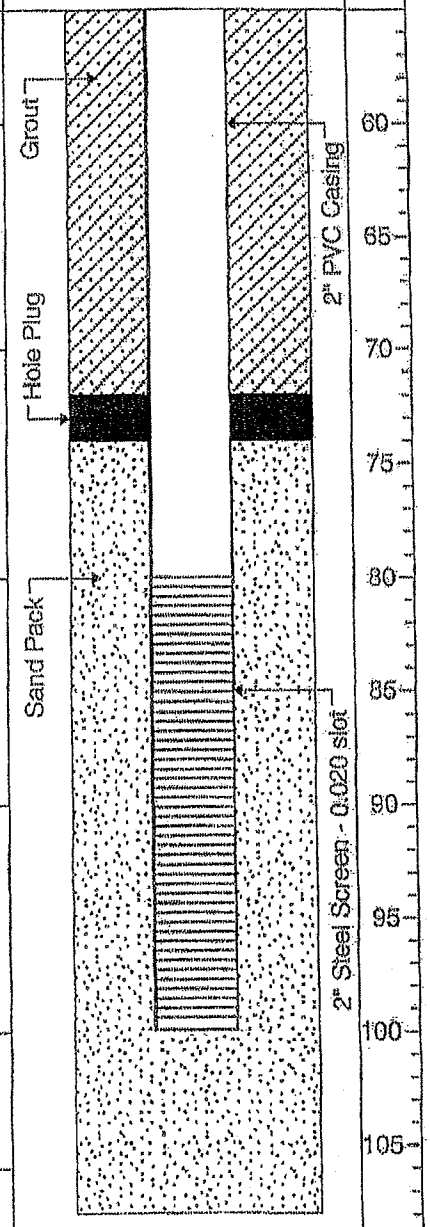
Well Number: OBS-1

Project No.: 005-1069
Project: Bridgeport
Client: City of Bridgeport
Location: Bridgeport, NE
Project Manager: Jennifer Hoevet

SUBSURFACE PROFILE

Depth	Symbol	Description	Elevation (ft)
			-60.00
60–65		Fine to medium sand	-70.00
70–75		Fine to medium sand w/ fine gravel --hole continues to collapse at ~75', can't get drill string in hole to full depth --added 2 bags quick gel - thicker mud now bringing up coarse gravel 1" to 1 1/2" diameter (not sure where coarse gravel interval is)	-80.00
80–85		Very coarse gravel - lots of tumbled brule 1" to 1 1/2" diameter	-90.00
90–95		Same as above - brule 3/4" to 1 1/2" diameter	-100.00
100–105		Same as above	-106.00
		Brule	-110.00
110			

Well Completion Details



Drill Date: 04/30/07
Total Depth: 108.00
Static Water Level: N/A
Pumping Rate: N/A
Pumping Water Level: N/A

OLSSON ASSOCIATES

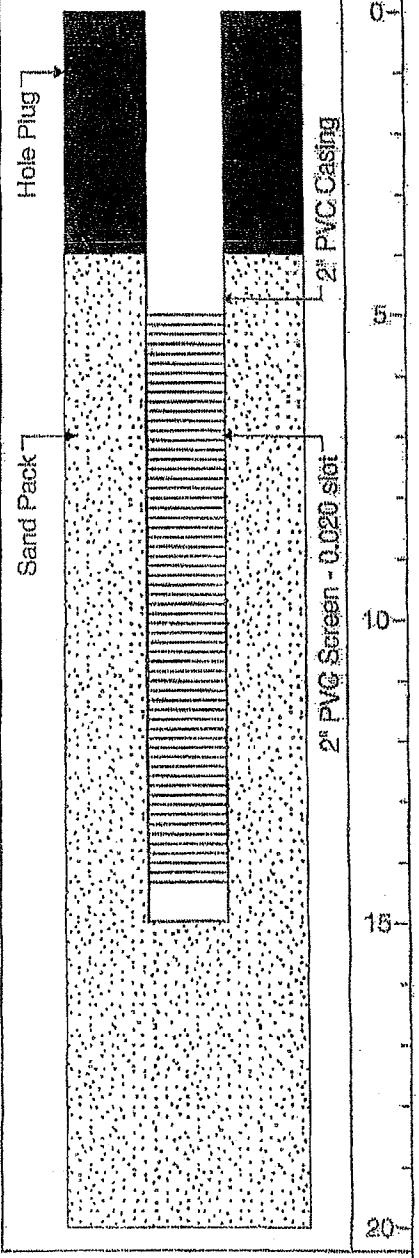
Well Number: OBS-2

Project No.: 005-1069
Project: Bridgeport
Client: City of Bridgeport
Location: Bridgeport, NE
Project Manager: Jennifer Hoevet

SUBSURFACE PROFILE

Depth	Symbol	Description	Elevation (ft)
0		Ground Surface	0.00
		Fine to medium sand w/ top soil and fill - found glass fragments in cuttings	
10			-10.00
		Fine to medium sand w/ a little bit of coarse sand	
20			-20.00

Well Completion Details



Drill Date: 05/01/07
Total Depth: 20.0
Static Water Level: N/A
Pumping Rate: N/A
Pumping Water Level: N/A

Appendix F-2

Well Drilling Reports, Electric Logs, and Well Registrations

Sargent Drilling Co.
INDUSTRIAL ENGINEERING
COMPLETE MUNICIPAL AND INDUSTRIAL
PUMPS AND WELL SERVICE
PO Box 627
HC 74, Box 28
Broken Bow, Nebraska
68822
Phone (308) 872-5125
Fax (308) 872-3050

TEST WELL LOG
CITY OF BRIDGEPORT
TEST HOLE – 2007-2
APRIL 30, 2007

PW-1

41.667194 103.089941
N 41° 40' 01.9" – W 103° 05' 20.2"
NW ¼, NE ¼, Section 33, Township 20 North, Range 50 West

0	6	Clay
6	20	Gravel
20	60	Fine to Medium Gravel, Hard Brule Clay Balls
60	80	Fine to Medium Gravel, Hard Brule Clay Layers
80	105	Fine to Medium Gravel
105	120	Brule Clay

6" Observation Well
00 – 60 Plain
60 – 100 Perf. (0.032 slot)

00 – 52 Grout
52 – 54 Holeplug
54 – 100 Gravel

Mail to
DNR
PO Box 94676
Lincoln, NE 68509-4676

Phone (402) 471-2363

October 2001
DNR Form 603

STATE OF NEBRASKA
DEPARTMENT OF NATURAL RESOURCES
WATER WELL REGISTRATION

11782006542693 2

FOR DEPARTMENT USE ONLY

Registration Date _____ Sequence No. _____ Registration No. G-144541
Owner Code No. _____ Receipt No. _____ NRD

1. a. Well Owner's First Name CITY OF Last Name BRIDGEPORT
   b. Company Name _____
   c. Correspondent Name _____ Attention _____
   Address BOX 280
   City BRIDGEPORT State NE Zip 69336-0280 Telephone 308 262 1623

2. a. Contractor's License No 3919407 Contractor's Name LOREN C. TAYLOR
   Contractor's Email Address _____
   b. Drilling Firm Name CHARLES SARGENT IRRIGATION INC (DRILLING) -BROKEN
   Address P.O. BOX 627
   City BROKEN BOW State NE Zip 68822 Telephone 308 872 5125
   Drilling Firm's Email Address DRILLING@SARGENTIRRIGATION.COM

3. a. Well location NW ¼ of the NE ¼ of Section 33, Township 20 North, Range 50 WEST MORRILL County.
   b. Natural Resources District NORTH PLATTE
   c. The well is 1171 feet from the NORTH section line and 2598 feet from the EAST section line
   or Latitude Degree 41 Minute 40 Second 01.9
   Longitude Degree -103 Minute 05 Second 20.2 Differential Correction ___ Yes X No
   d. Street address and subdivision, if applicable _____
   Block _____ Lot _____
   e. Location of water use, if applicable (give legal descriptions) NWNE S33 T20 R50W
   f. If for irrigation, the land to be irrigated is _____ acres.
   Well reference letter(s), if applicable _____

4. Permits
   Management Area Permit Number _____
   Geothermal Permit Number _____
   Municipal Permit Number _____
   Well Spacing Permit Number _____
   Surface Water Permit Number _____
   Industrial Permit Number _____
   Transfer Out-Of-State Permit Number _____
   Conduct Permit Number _____
   Other Permit Number _____

5. Purpose of well (indicate one) ___Aquaculture ___Commercial/Industrial ___Dewatering (over 90 days)
   ___Domestic ___Ground Heat Exchanger ___Groundwater Source Heat Pump ___Irrigation ___Injection
   ___Livestock ___Monitoring X Observation ___Public Water Supply (with spacing (446-638))
   ___Public Water Supply (without spacing) ___Recovery ___ Other _____ (indicate use)

6. Wells in a Series.
   a. Is this well a part of a series? ___Yes *(go to part b of this section)* X No *(go to part 7 of this application)*
   b. If one or more of the wells in the series is currently registered, give the well registration number _____
   c. How many wells in the series are you registering at this time? _____

7. Replacement and abandoned well information.
   a. Is this well a replacement well? ___Yes X No
   b. Registration number of abandoned well _____ If not registered, date abandoned well was constructed
   c. Replacement well is _____ feet from abandoned well. d. Abandoned well last operated
   e. Original well pump column size _____ inches. f. Completion of original well abandonment on
   g. Location of water use of abandoned well _____

8. Pump Information.

a. Is pump installed at this time ____Yes __X__No

Is pump installed by well owner in section 1? ____Yes __X__No Is pump installed by contractor in section 2? ____Yes __X__No

If pump installed by pump installer, please fill out license number below

b. Pump Installer's License No. _____ Pump Installer's Name _____

Pump Installer's Email Address _____

Pump Installer's Firm Name _____

Pump Installer's Firm Address _____

City _____ State _____ Zip -0000 Telephone _____

Pump Installer's Firm Email Address _____

c. Pumping rate _____ gallons per minute _____ Measured _____ Estimated

d. Drop pipe diameter _____ inches

e. Length of drop pipe _____ feet

f. Pumping equipment installed

g. Pump Brand _____

h. This well will be used to pump less than 50 gpm __X__Yes ____No

9. Well Construction Information.

a. Total well depth 100 feet.

b. Static water level _____ feet.

c. Pumping water level _____ feet

d. Well Construction began 04/30/2007

e. Well Construction completed 04/30/2007

f. Bore hole diameter in inches Top 12 Bottom 12

g. Casing and Screen Joints are: Welded __X__ Glued _____ Threaded _____ Other _____

10. Well Construction (Casing & Screen)- c, d, e, & g measurements should be in inches to three decimal places

a		b	c	d	e	f	g	h
Placement Depth in Feet		Casing or Screen	Inside Diameter	Outside Diameter	Wall Thickness	Type of Material	Screen Slot Size	Trade Name
From	To							

11. Grout and Gravel Pack

Placement Depth in Feet		Grout or Gravel Pack	Material Description
From	To		

12. Geologic Materials Logged

Depth in Feet From	To	Description	Depth in Feet From	To	Description

(Additional sheets may be submitted)

13. I am familiar with the information submitted on this registration, and to the best of my knowledge it is true.

_____ _____

Water Well Contractor's Signature Date

WELL CONSTRUCTION LOG - 117820065424932

To - From	Case/Screen	I.D.	O.D.	Thk.	Mat.	Slot	Trade Name
0.0 - 60.0	Casing	6.03	6.63	0.28	Steel	0.000	Livingston
60.0 - 100.0	Screen	6.03	6.63	0.28	S Steel	0.032	Johnson

GROUT AND GRAVEL PACK - 117820065424932

To - From	Grout/Gravel	Material Desc.
00.0 - 52.0	Grout	Cement Grout
52.0 - 54.0	Gravel	Bentonite Holeplug
54.0 - 100.0	Gravel	\"O\" Well Pack

GEOLOGICAL LOGS - 11782006542493Z

To	-	From	Geological Material Desc.
00.0	-	06.0	Clay
06.0	-	20.0	Gravel
20.0	-	60.0	Fine to Medium Gravel, Hard Brule Clay Balls
60.0	-	80.0	Fine to Medium Gravel, Hard Brule Clay Layers
80.0	-	100.0	Fine to Medium Gravel

Sargent Drilling Co.
INDUSTRIAL ENGINEERING
COMPLETE MUNICIPAL AND INDUSTRIAL
PUMPS AND WELL SERVICE

PO Box 627
HC 74, Box 28

Broken Bow, Nebraska
68822

Phone (308) 872-5125
Fax (308) 872-3050

TEST WELL LOG
CITY OF BRIDGEPORT
TEST HOLE – 2007-1
APRIL 30, 2007

41.666861 103.08927
N 41° 40' 00.7" – W 103° 05' 21.4"
NW ¼, NE ¼, Section 33, Township 20 North, Range 50 West

0	5	Clay
5	20	Gravel
20	80	Fine to Medium Gravel
80	100	Medium to Large Gravel, Brule Clay Layers

2" Observation Well
00 – 80 Plain
80 – 100 Perf. (0.020 slot)

00 – 71 Grout
71 – 74 Holeplug
74 – 100 Gravel

Mail to
DNR
PO Box 94676
Lincoln, NE 68509-4676

Phone (402) 471-2363

October 2001
DNR Form 145

STATE OF NEBRASKA
DEPARTMENT OF NATURAL RESOURCES
WATER WELL REGISTRATION

117819832019183

FOR DEPARTMENT USE ONLY

Registration Date _____ Sequence No. _____ Registration No. G-144500
Owner Code No. _____ Receipt No. _____ _____ NRD

1. a. Well Owner's First Name CITY OF Last Name BRIDGEPORT
   b. Company Name _____
   c. Correspondent Name _____ Attention _____
   Address BOX 280
   City BRIDGEPORT State NE Zip 69336-0280 Telephone 308 262 1623

2. a. Contractor's License No 3919407 Contractor's Name LOREN C.TAYLOR
   Contractor's Email Address _____
   b. Drilling Firm Name CHARLES SARGENT IRRIGATION INC (DRILLING) -BROKEN
   Address P.O. BOX 627
   City BROKEN BOW State NE Zip 68822 Telephone 308 872 5125
   Drilling Firm's Email Address DRILLING@SARGENTIRRIGATION.COM

3. a. Well location NW ¼ of the NE ¼ of Section 33, Township 20 North, Range 50 WEST MORRILL County.
   b. Natural Resources District NORTH PLATTE
   c. The well is 1293 feet from the NORTH section line and 2684 feet from the EAST section line
   or Latitude Degree 41 Minute 40 Second 00.7
   Longitude Degree -103 Minute 05 Second 21.4 Differential Correction ___ Yes X No
   d. Street address and subdivision, if applicable _____
   Block _____ Lot _____
   e. Location of water use, if applicable (give legal descriptions) NWNE S33 T20 R50W
   f. If for irrigation, the land to be irrigated is _____ acres.
   Well reference letter(s), if applicable _____

4. Permits
   Management Area Permit Number _____
   Geothermal Permit Number _____
   Municipal Permit Number _____
   Well Spacing Permit Number _____
   Surface Water Permit Number _____
   Industrial Permit Number _____
   Transfer Out-Of-State Permit Number _____
   Conduct Permit Number _____
   Other Permit Number _____

5. Purpose of well (indicate one) ___ Aquaculture ___ Commercial/Industrial ___ Dewatering (over 90 days)
   ___ Domestic ___ Ground Heat Exchanger ___ Groundwater Source Heat Pump ___ Irrigation ___ Injection
   ___ Livestock ___ Monitoring X Observation ___ Public Water Supply (with spacing (46-638))
   ___ Public Water Supply (without spacing) ___ Recovery ___ Other _____ (indicate use)

6. Wells in a Series.
   a. Is this well a part of a series? ___ Yes *(go to part b of this section)* X No *(go to part 7 of this application)*
   b. If one or more of the wells in the series is currently registered, give the well registration number _____
   c. How many wells in the series are you registering at this time? _____

7. Replacement and abandoned well information.
   a. Is this well a replacement well? ___ Yes X No
   b. Registration number of abandoned well _____ If not registered, date abandoned well was constructed _____
   c. Replacement well is ___ feet from abandoned well. d. Abandoned well last operated
   e. Original well pump column size ___ inches. f. Completion of original well abandonment on
   g. Location of water use of abandoned well _____

8. Pump Information.

a. Is pump installed at this time _____Yes __X__No

Is pump installed by well owner in section 1? ____Yes __X__No Is pump installed by contractor in section 2? ____Yes __X__No

If pump installed by pump installer, please fill out license number below

b. Pump Installer's License No. _____ Pump Installer's Name _____

Pump Installer's Email Address _____

Pump Installer's Firm Name _____

Pump Installer's Firm Address _____

City_____ State _____ Zip ____-0000 Telephone _____

Pump Installer's Firm Email Address _____

c. Pumping rate _____ gallons per minute _____ Measured _____ Estimated

d. Drop pipe diameter _____ inches

e. Length of drop pipe _____ feet

f. Pumping equipment installed

g. Pump Brand _____

h. This well will be used to pump less than 50 gpm __X__Yes ____No

9. Well Construction Information.

a. Total well depth ____100____ feet.

b. Static water level _____ feet.

c. Pumping water level _____ feet

d. Well Construction began 04/30/2007

e. Well Construction completed 04/30/2007

f. Bore hole diameter in inches Top ___6___ Bottom ___6___

g. Casing and Screen Joints are: Welded_____ Glued ___X___ Threaded _____ Other _____

10. Well Construction (Casing & Screen)- c, d, e, & g measurements should be in inches to three decimal places

a		b	c	d	e	f	g	h
Placement Depth in Feet		Casing or Screen	Inside Diameter	Outside Diameter	Wall Thickness	Type of Material	Screen Slot Size	Trade Name
From	To							

11. Grout and Gravel Pack

Placement Depth in Feet		Grout or Gravel Pack	Material Description
From	To		

12. Geologic Materials Logged

Depth in Feet From	To	Description	Depth in Feet From	To	Description

(Additional sheets may be submitted)

13. I am familiar with the information submitted on this registration, and to the best of my knowledge it is true.

_____ _____

Water Well Contractor's Signature Date

WELL CONSTRUCTION LOG - 1178198320191B3

To - From	Case/Screen	I.D.	O.D.	Thk.	Mat.	Slot	Trade Name
0.0 - 80.0	Casing	2.05	2.38	0.15	Plastic	0.000	Titan
80.0 - 100.0	Screen	2.05	2.38	0.15	S Steel	0.020	Titan

GROUT AND GRAVEL PACK - 1178198320191B3

To - From	Grout/Gravel	Material Desc.
00.0 - 71.0	Grout	Concrete Grout
71.0 - 74.0	Gravel	Bentonite Holeplug
74.0 - 100.0	Gravel	\"O\" Well Pack

GEOLOGICAL LOGS - 1178198320191B3

To	- From	Geological Material Desc.
00.0	- 05.0	Clay
05.0	- 20.0	Gravel
20.0	- 80.0	Fine to Medium Gravel
80.0	- 100.0	Medium to Large Gravel, Brule Clay Layers

Sargent Drilling Co.
INDUSTRIAL ENGINEERING
COMPLETE MUNICIPAL AND INDUSTRIAL
PUMPS AND WELL SERVICE
PO Box 627
HC 74, Box 28
Broken Bow, Nebraska
68822
Phone (308) 872-5125
Fax (308) 872-3050

TEST WELL LOG
CITY OF BRIDGEPORT OBS-2
TEST HOLE – 2007-3
MAY 1, 2007

41.6686111 103.0900278
N 41° 40' 07.0" – W 103° 05' 24.1"
NE ¼, NW ¼, Section 33, Township 20 North, Range 50 West

0	4	Clay
4	20	Gravel

2" Observation Well
00 – 05 Plain
05 – 20 Perf. (0.020 slot)

00 – 09 Holeplug
09 – 20 Gravel

Mail to
DNR
PO Box 94676
Lincoln, NE 68509-4676

Phone (402) 471-2363

October 2001
DNR Form 188

STATE OF NEBRASKA
DEPARTMENT OF NATURAL RESOURCES
WATER WELL REGISTRATION

11782018B024934

FOR DEPARTMENT USE ONLY

Registration Date _____ Sequence No. _____ Registration No. G-144501
Owner Code No. _____ Receipt No. _____ _____ NRD

1. a. Well Owner's First Name CITY OF Last Name BRIDGEPORT
   b. Company Name _____
   c. Correspondent Name _____ Attention _____
   Address BOX 280
   City BRIDGEPORT State NE Zip 69336-0280 Telephone 308 262 1623

2. a. Contractor's License No 3919407 Contractor's Name LOREN C. TAYLOR
   Contractor's Email Address _____
   b. Drilling Firm Name CHARLES SARGENT IRRIGATION INC (DRILLING) -BROKEN
   Address P.O. BOX 627
   City BROKEN BOW State NE Zip 68822 Telephone 308 872 5125
   Drilling Firm's Email Address DRILLING@SARGENTIRRIGATION.COM

3. a. Well location NE ¼ of the NW ¼ of Section 33, Township 20 North, Range 50 WEST MORRILL County.
   b. Natural Resources District NORTH PLATTE
   c. The well is 653 feet from the NORTH section line and 2582 feet from the WEST section line
   or Latitude Degree 41 Minute 40 Second 07.0
   Longitude Degree -103 Minute 05 Second 24.1 Differential Correction ___Yes X No
   d. Street address and subdivision, if applicable _____
   Block _____ Lot _____
   e. Location of water use, if applicable (give legal descriptions) NENW S33 T20 R50N
   f. If for irrigation, the land to be irrigated is _____ acres.
   Well reference letter(s), if applicable _____

4. Permits
   Management Area Permit Number _____
   Geothermal Permit Number _____
   Municipal Permit Number _____
   Well Spacing Permit Number _____
   Surface Water Permit Number _____
   Industrial Permit Number _____
   Transfer Out-Of-State Permit Number _____
   Conduct Permit Number _____
   Other Permit Number _____

5. Purpose of well (indicate one) ___Aquaculture ___Commercial/Industrial ___Dewatering (over 90 days)
   ___Domestic ___Ground Heat Exchanger ___Groundwater Source Heat Pump ___Irrigation ___Injection
   ___Livestock ___Monitoring X Observation ___Public Water Supply (with spacing (46-638))
   ___Public Water Supply (without spacing) ___Recovery ___Other _____ (indicate use)

6. Wells in a Series.
   a. Is this well a part of a series? ___Yes *(go to part b of this section)* X No *(go to part 7 of this application)*
   b. If one or more of the wells in the series is currently registered, give the well registration number _____
   c. How many wells in the series are you registering at this time? _____

7. Replacement and abandoned well information.
   a. Is this well a replacement well? ___Yes X No
   b. Registration number of abandoned well _____ If not registered, date abandoned well was constructed
   c. Replacement well is _____ feet from abandoned well. d. Abandoned well last operated
   e. Original well pump column size _____ inches. f. Completion of original well abandonment on
   g. Location of water use of abandoned well _____

8. Pump Information.

a. Is pump installed at this time ____Yes __X__No

Is pump installed by well owner in section 1? ____Yes __X__No Is pump installed by contractor in section 2? ____Yes __X__No

If pump installed by pump installer, please fill out license number below

b. Pump Installer's License No. _____ Pump Installer's Name _____

Pump Installer's Email Address _____

Pump Installer's Firm Name _____

Pump Installer's Firm Address _____

City _____ State _____ Zip -0000 Telephone _____

Pump Installer's Firm Email Address _____

c. Pumping rate _____ gallons per minute _____ Measured _____ Estimated

d. Drop pipe diameter _____ inches

e. Length of drop pipe _____ feet

f. Pumping equipment installed

g. Pump Brand _____

h. This well will be used to pump less than 50 gpm __X__Yes ____No

9. Well Construction Information.

a. Total well depth ____20____ feet.

b. Static water level _____ feet.

c. Pumping water level _____ feet

d. Well Construction began 05/01/2007

e. Well Construction completed 05/01/2007

f. Bore hole diameter in inches Top ____6____ Bottom ____6____

g. Casing and Screen Joints are: Welded _____ Glued ____X____ Threaded _____ Other _____

10. Well Construction (Casing & Screen)- c, d, e, & g measurements should be in inches to three decimal places

a		b	c	d	e	f	g	h
Placement Depth in Feet		Casing or Screen	Inside Diameter	Outside Diameter	Wall Thickness	Type of Material	Screen Slot Size	Trade Name
From	To							

11. Grout and Gravel Pack

Placement Depth in Feet		Grout or Gravel Pack	Material Description
From	To		

12. Geologic Materials Logged

Depth in Feet From	To	Description	Depth in Feet From	To	Description

(Additional sheets may be submitted)

13. I am familiar with the information submitted on this registration, and to the best of my knowledge it is true.

_____ _____

Water Well Contractor's Signature Date

WELL CONSTRUCTION LOG - 117820188824934

To	-	From	Case/Screen	I.D.	O.D.	Thk.	Mat.	Slot	Trade Name
0.0	-	4.0	Casing	2.05	2.38	0.15	Plastic	0.000	Titan
4.0	-	20.0	Screen	2.05	2.38	0.15	Plastic	0.020	Titan

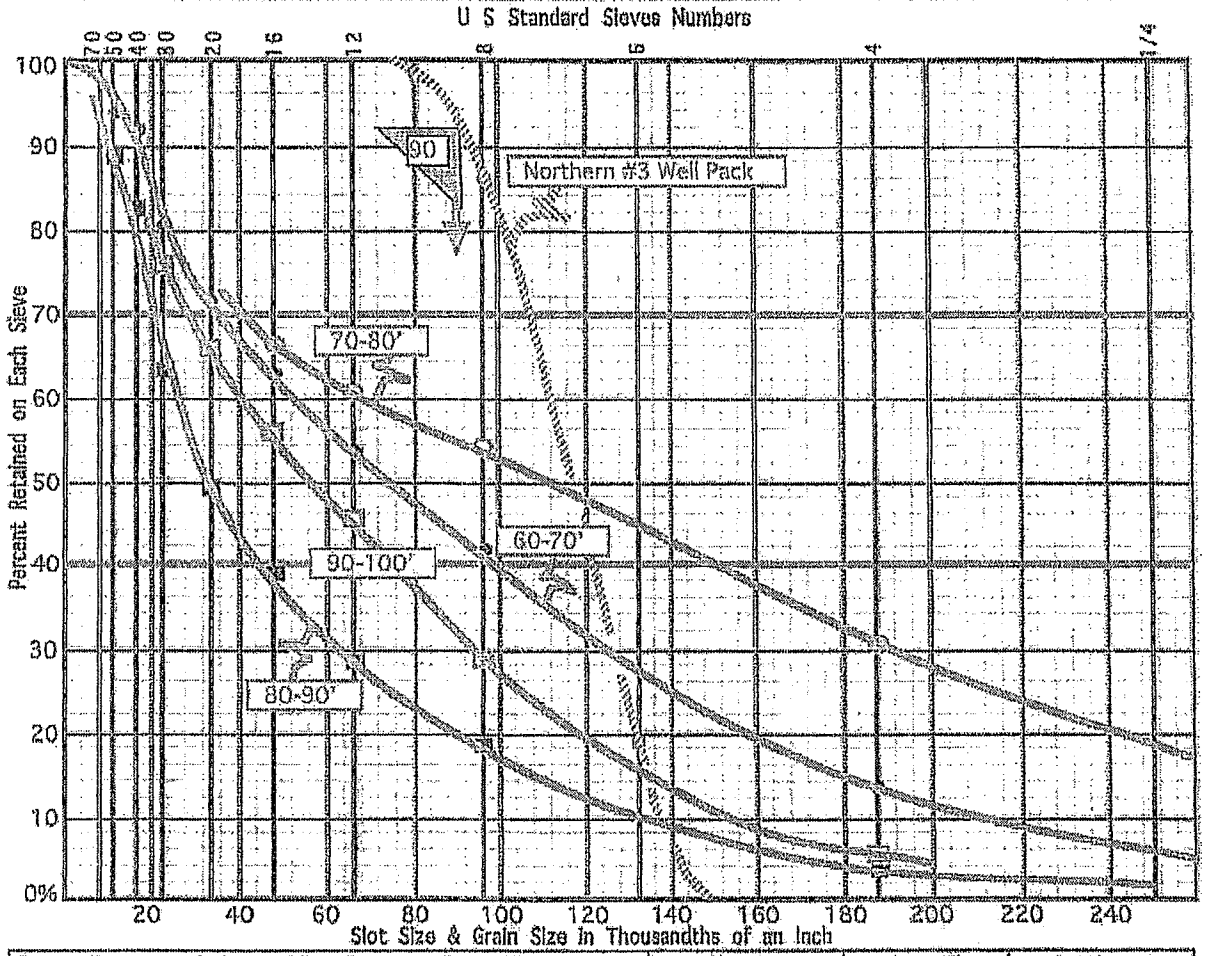
GROUT AND GRAVEL PACK - 117820188824934

To	-	From	Grout/Gravel	Material Desc.
00.0	-	09.0	Gravel	Bentonite Holeplug
09.0	-	20.0	Gravel	\"0\" Well Pack

DESIGN WATER TECHNOLOGIES **Coarse Graph**

Job Name Bridgeport, TH#1 Date: May 14, 2007
Contractor Sargent Drilling, Broken Bow, Nebraska Engineer Olsson Associates
Comments 5' SWL. Water Table Aquifer Design Analysis by David T. Hanson, Design Water Technologies

Graph Code for Formation Samples
60-70' 70-80' 80-90' 90-100'



Screen Recommendations Alloy Const: 105 Wire Diameter: 18" PS "Shallow" construction Open Area: 313.2 sq. in./ft or 46%. Transmitting Capacity: 97.1 GPM/ft @ .1'/sec	Slot 90 (.090") slot	Length 30'	Setting 70-100'

Comments/Recommendations: The recommended filter pack should be similar to the Northern #3 Well Pack available from Northern Gravel in Muscatine, Iowa.

Our recommendations are based upon collected samples. We assume no responsibility for the successful, sand free operation of a well.

5920 Covington Rd., Shorewood, MN 55331 Toll Free 888.437.0426 or (888 4 dsn h2o)
Phone 952.474.4657 • Fax 952.470.6637 • E-mail designh2o@aol.com

Design Considerations
This well will probably react to pumping as a Water Table Aquifer. The recommended screen length (30') represents screening 30% of the aquifer thickness (100' minus 5' static) which is standard design for optimum pumping results and maximum available drawdown.

A screen set to a depth of 100' should have a minimum calculated collapse of 20 psi. The recommended screen as manufactured by Alloy Screen of Houston Texas has a calculated collapse strength of 37 psi.

Estimates of Well Yield
Visual estimates of Permeability may range between 1000 to 1400 gallons per day/foot squared. This would calculate to an estimated Transmissivity between 95,000 to 130,000 gallons per day. Estimated field Specific Capacity would be estimated between 32 to 43 GPM/foot of drawdown assuming a field well efficiency of 70%.

Please use these only as estimates as all calculations are based upon visual estimates of similar size sand and gravel which may not be truly representative of the actual formation, or any layering effects. It also can not account for any boundary or recharge conditions within the aquifer.

If you have any questions, please call. Thank you.

Sincerely,

Design Water Technologies

David T. Hanson, President
Alloy Screen Technical Representative

Check out our new web site @ www.designwater.com

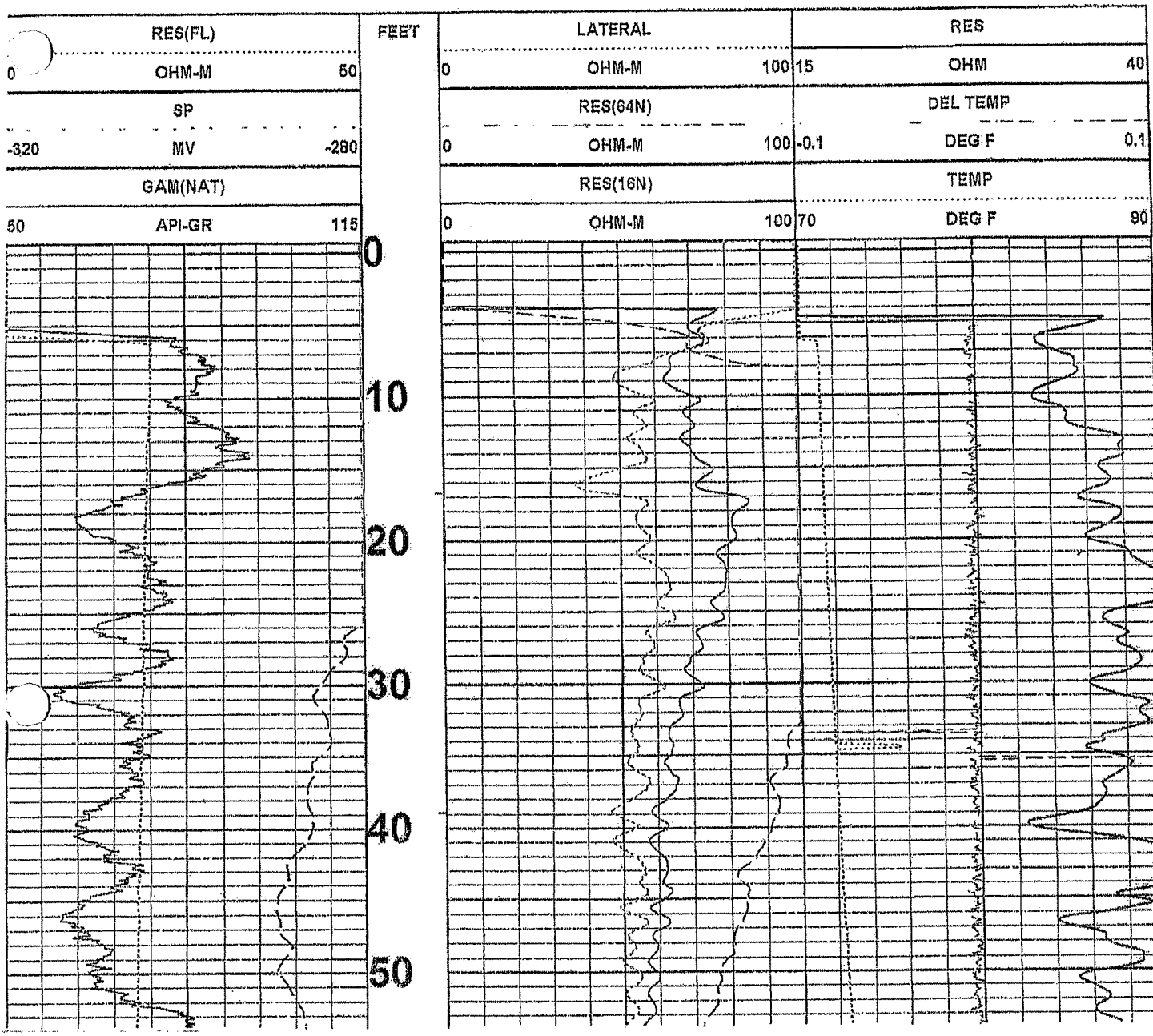
SARGENT LOGGING SERVICES

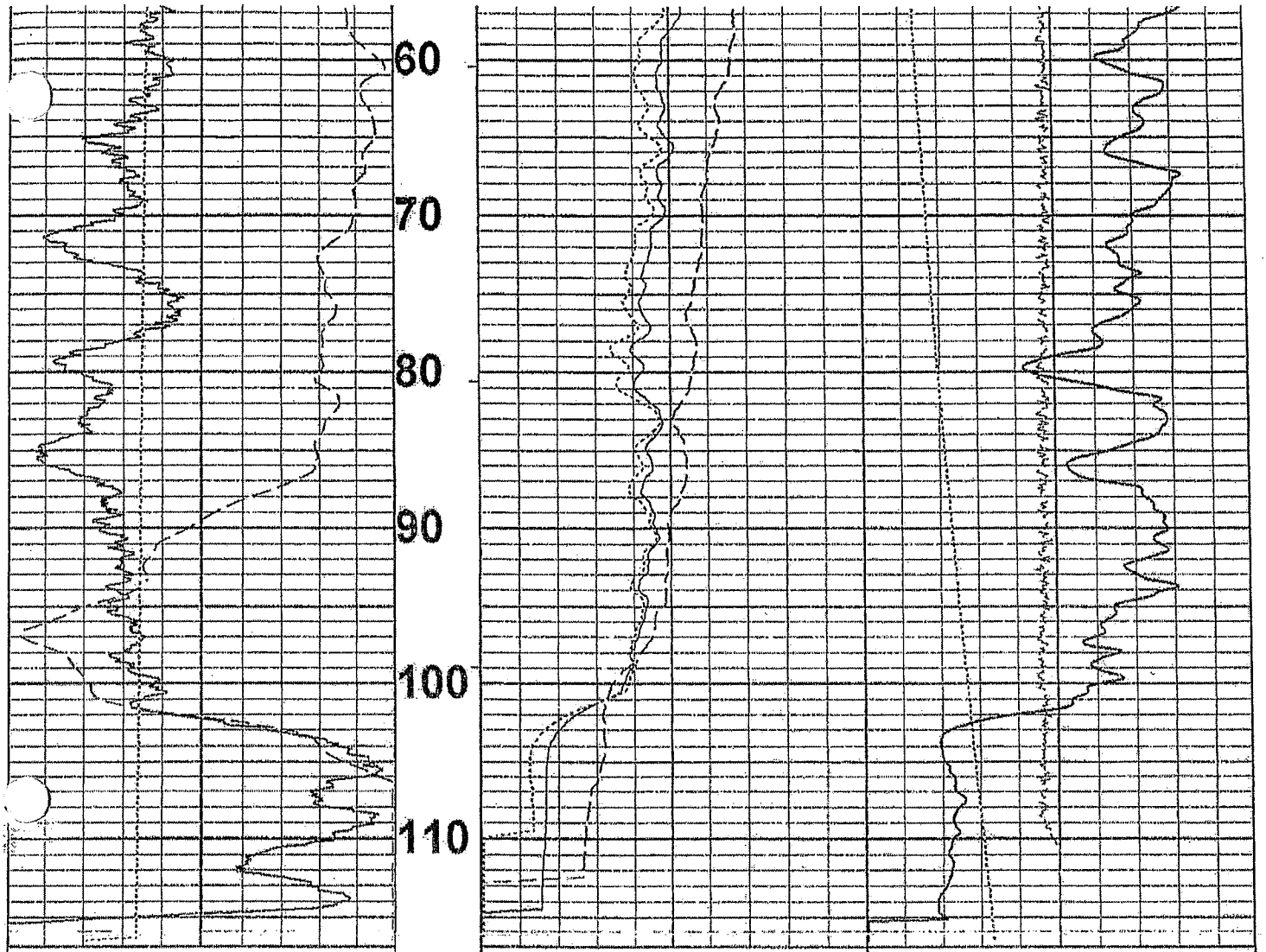
TH2007-1

COMPANY	: CITY OF BRIDGEPORT			OTHER SERVICES:	
WELL	: TH2007-1				
LOCATION/FIELD	: BALL FEILD				
COUNTY	: MORRILL				
STATE	: NE				
SECTION	:	TOWNSHIP	:	RANGE	:
DATE	: 04/30/07	PERMANENT DATUM	:		
DEPTH DRILLER	: 120			KB	:
LOG BOTTOM	: 116.80	LOG MEASURED FROM:	GROUND	DF	:
LOG TOP	: -0.70	DRL MEASURED FROM:	GROUND	GL	:
CASING DIAMETER	:	LOGGING UNIT	: 0618		
CASING TYPE	:	FIELD OFFICE	: BROKEN BOW		
CASING THICKNESS:	0	RECORDED BY	: SHAD Y.		
BIT SIZE	: 6	BOREHOLE FLUID	: 0	FILE	: ORIGINAL
MAGNETIC DECL.	: 0	RM	: 0	TYPE	: 8044A
MATRIX DENSITY	: 2.71	RM TEMPERATURE	: 0		
NEUTRON MATRIX	: Dolomite	MATRIX DELTA T	: 140		
				THRESH:	4000

LAT. N. 41-40-01.9
LONG. W. 103-05-20.2

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS


RES(FL)
0
OHM-M
50
SP
-320
MV
-280
GAM(NAT)
50
API-GR
115
FEET
0
10
20
30
40
50
LATERAL
0
OHM-M
100
RES(64N)
0
OHM-M
100
RES(16N)
0
OHM-M
100
RES
15
OHM
40
DEL TEMP
-0.1
DEG F
0.1
TEMP
70
DEG F
90



50	API-GR	115	0 OHM-M 100	70 DEG F 90
GAM(NAT)			RES(16N)	TEMP
-320	MV	-280	0 OHM-M 100	-0.1 DEG F 0.1
SP			RES(64N)	DEL TEMP
0	OHM-M	50	0 OHM-M 100	15 OHM 40
RES(FL)	FEET		LATERAL	RES

TOOL CALIBRATION TH2007-1 04/30/07 11:22
TOOL 8044A
SERIAL NUMBER 929

	DATE	TIME	SENSOR	STANDARD	RESPONSE
1	Dec06,04	16:34:21	GAM(NAT)	0.000 [API-GR]	60065.00 [CPS]
	Dec06,04	16:34:21	GAM(NAT)	Default [API-GR]	Default [CPS]
2	Jun04,03	17:36:46	RES(FL)	1.090 [OHM-M]	10350.00 [CPS]
	Jun04,03	17:36:46	RES(FL)	31.670 [OHM-M]	21930.00 [CPS]
3	Apr30,07	17:13:05	SP	0.000 [MV]	59540.00 [CPS]
	Apr30,07	17:13:05	SP	400.000 [MV]	20065.00 [CPS]
	Apr30,07	17:13:28	RES(16N)	0.000 [OHM-M]	4000.00 [CPS]
	Apr30,07	17:13:28	RES(16N)	1995.000 [OHM-M]	102450.00 [CPS]
6	Apr30,07	17:13:47	RES(64N)	0.000 [OHM-M]	3970.00 [CPS]
	Apr30,07	17:13:47	RES(64N)	1988.000 [OHM-M]	103500.00 [CPS]
6	Dec06,04	14:56:50	TEMP	64.000 [DEG F]	132600.00 [CPS]
	Dec06,04	14:56:50	TEMP	103.000 [DEG F]	83590.00 [CPS]
7	Apr30,07	17:14:16	RES	0.000 [OHM]	10639.00 [CPS]
	Apr30,07	17:14:16	RES	988.000 [OHM]	60017.00 [CPS]

Appendix C

Pump Test Analysis Sheets

Olsson Associates
1111 Lincoln Mall, Suite 111
Lincoln, NE 68508

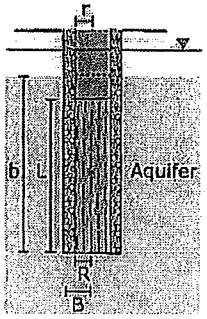
Wells

Project: Bridgeport Water Supply Study

Number: 006-1069

Client: City of Bridgeport

Location: Bridgeport, NE



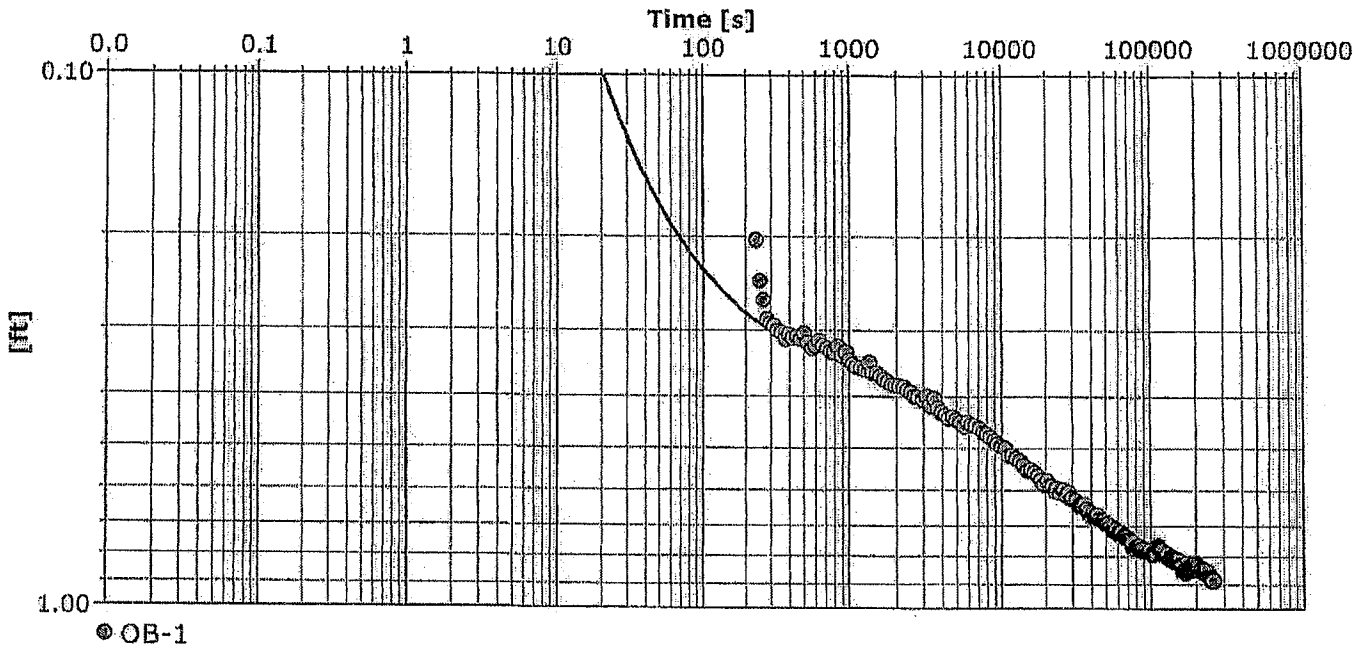
	Name	X [ft]	R [ft]	L [ft]	r [ft]	B [ft]	b [ft]
1	PW-1	0	0.25	40	0.25	0.5	97.5
2	OB-1	-109	0.0833	20	0.0833	0.25	97.5
3	OB-2	-300	0.0833	15	0.0833	0.25	97.5

Appendix F-3

Pump Test Analysis Sheets

Olsson Associates 1111 Lincoln Mall, Suite 111 Lincoln, NE 68508	Pumping Test Analysis Report
	Project: Bridgeport Water Supply Study
	Number: 005-1069
	Client: City of Bridgeport

Location: Bridgeport, NE	Pumping Test: Pumping Test NE of Ball Field	Pumping well: PW-1
Test conducted by: Olsson Associates		Test date: 5/7/2007
Analysis performed by: Dryter	OB-1 Boulton	Analysis date: 7/5/2007
Aquifer Thickness: 97.50 ft	Discharge rate: 432 [U.S. gal/min]	

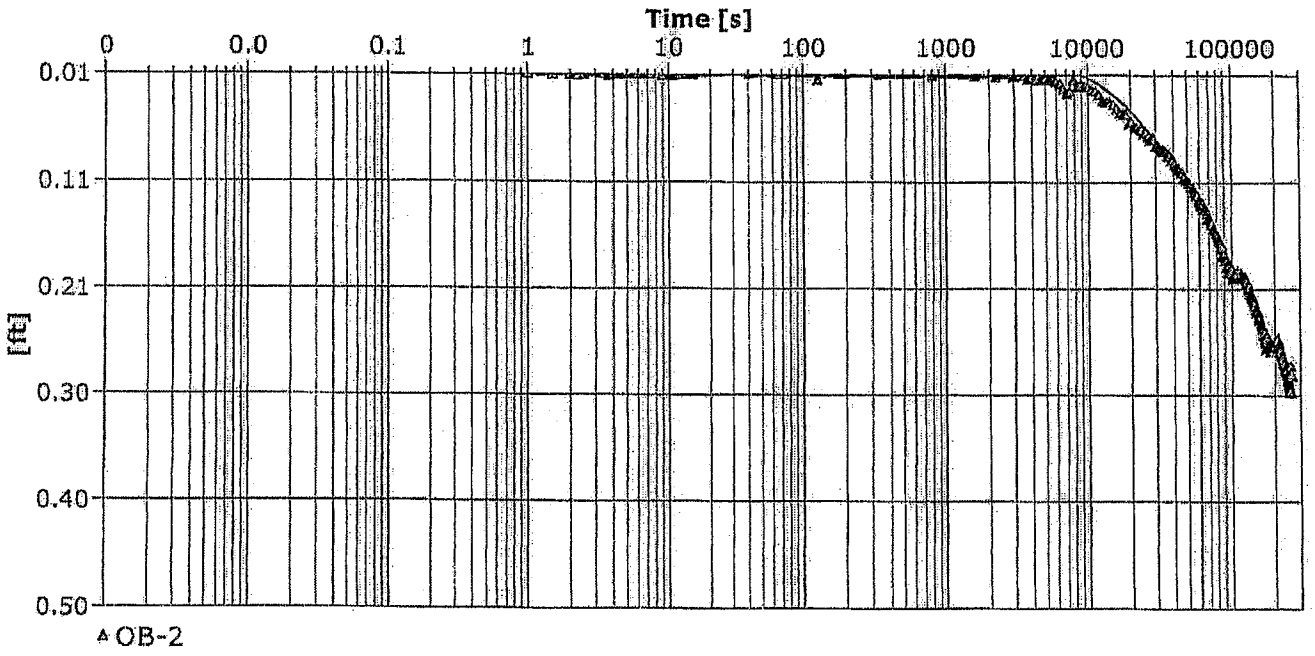


Calculation after Boulton

Observation well	Transmissivity [ft²/d]	Hydraulic Conductivity [ft/d]	Specific Yield	Drainage factor	Ratio Sy/S	Radial distance to PW [ft]
OB-1	5.77×10^{4}	5.92×10^{2}	1.40×10^{-2}	8.71×10^{-3}	1.00×10^{1}	109.0

Olsson Associates 1111 Lincoln Mall, Suite 111 Lincoln, NE 68508	Pumping Test Analysis Report
	Project: Bridgeport Water Supply Study
	Number: 005-1069
	Client: City of Bridgeport

Location: Bridgeport, NE	Pumping Test: Pumping Test NE of Ball Field	Pumping well: PW-1
Test conducted by: Olsson Associates		Test date: 5/7/2007
Analysis performed by: Dryer	OB-2 Theis Jacob	Analysis date: 7/5/2007
Aquifer Thickness: 97.50 ft	Discharge rate: 432 [U.S. gal/min]	

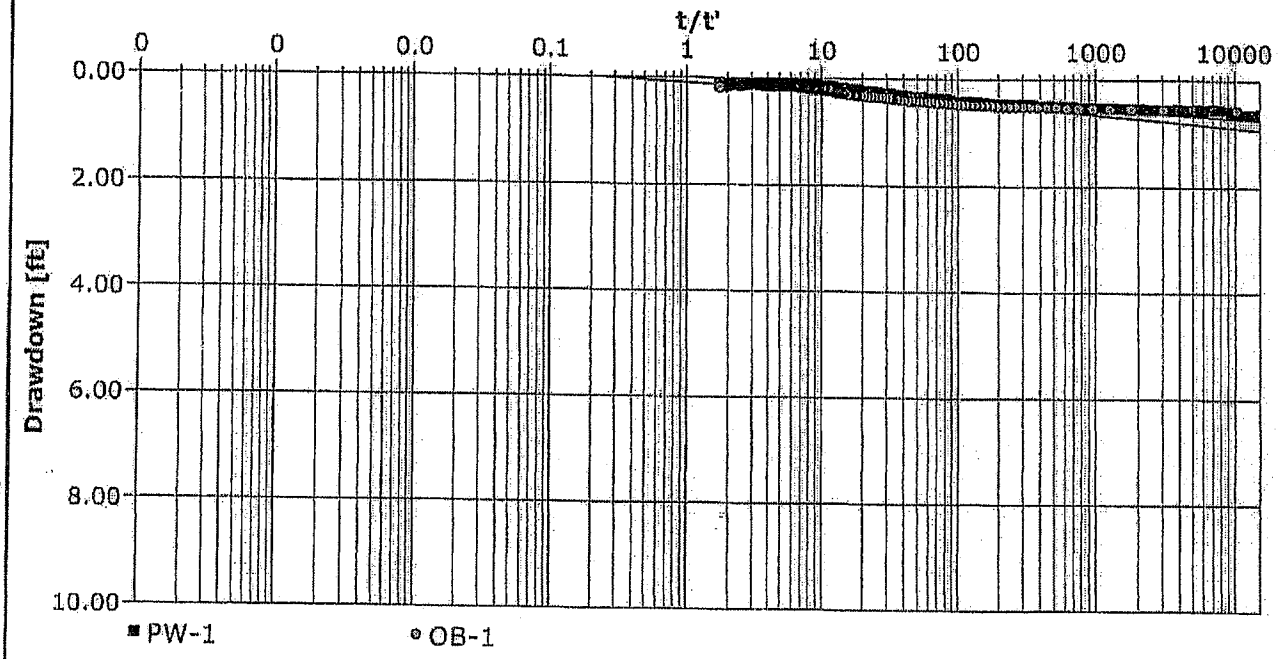


Calculation after Theis with Jacob Correction

Observation well	Transmissivity [ft²/d]	Hydraulic Conductivity [ft/d]	Storage coefficient	Radial distance to PW [ft]	
OB-2	5.38×10^{4}	5.52×10^{2}	1.12×10^{-1}	574.54	

Olsson Associates 1111 Lincoln Mall, Suite 111 Lincoln, NE 68508	Pumping Test Analysis Report
	Project: Bridgeport Water Supply Study
	Number: 005-1069
	Client: City of Bridgeport

Location: Bridgeport, NE	Pumping Test: Recovery Test	Pumping well: PW-1
Test conducted by: Olsson Associates		Test date: 6/25/2007
Analysis performed by: Kgriffin	Final Recovery Analysis	Analysis date: 7/5/2007
Aquifer Thickness: 97.50 ft	Discharge: variable, average rate 432 [U.S. gal/min]	



Calculation after Theis & Jacob

Observation well	Transmissivity [ft²/d]	Hydraulic Conductivity [ft/d]	Radial distance to PW [ft]	
PW-1	6.55×10^4	6.72×10^2	0.25	
OB-1	9.87×10^4	1.01×10^3	109.0	
Average	8.21×10^4	8.42×10^2		

Appendix F-4

Water Quality Reports

Nebraska Health and Human Services
Regulation and Licensure - Laboratory Services
3701 South 14th Street
Lincoln, NE 68502
(402) 471-2122
(402) 471-2080 (fax)

NE3112303
~~BRIDGEPORT, CITY OF~~
WAYNE E. KAUTZ
609 Main
PO Box 280
BRIDGEPORT, NE 69336

Laboratory Report Printed on: JUN-05-07

Laboratory Analysis for: 13 PARAMETER

Sample Comments: SPECIAL REQUEST (MINUS BACTI)

Laboratory Number: P32014-1
Sampled By: SARGENT DRILLING
Location: BRIDGEPORT NE
Well ID: 950

Date Collected: 10-May-2007 12:00 PM
Date Received: 14-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
pH	7.62			pH	150.1		05/16/07	SH
SULFATE	370		50	mg/l	EPA 375.4		06/03/07	JN
Chloride	40.9		1	mg/l	4500CL-E		05/14/07	km
IRON	57.6		50	ug/l	SM3111B		05/16/07	CD
Hardness, Total	430		4	mg/l	2340C		05/16/07	SH
Solids, Total Dissolved (Tds)	929		10	mg/l	160.1		05/18/07	SH
Alkalinity, Total	376		20	mg/l	2320B		05/16/07	SH
CALCIUM	136		.15	mg/l	215.1		05/16/07	CD
SODIUM	137		10	mg/l	SM3111B		05/16/07	CD
Nitrate+Nitrite (As N)	3.1		.05	mg/l	353.2		05/16/07	km
Fluoride	.31		.2	mg/l	4500F-C		05/17/07	km
MANGANESE	3.7		1	ug/l	200.8		05/16/07	CC

Note: see reverse side of report for description of acronyms and data qualifiers
For inquiries on result interpretation call: (402) 471-6435

Regulation and Licensure - Laboratory Services
3701 South 14th Street
Lincoln, NE 68502
(402) 471-2122
(402) 471-2080 (fax)

NE3112303
BRIDGEPORT, CITY OF
WAYNE E. KAUTZ
809 Main
PO Box 280
BRIDGEPORT, NE 69336

Laboratory Report Printed on: MAY-18-07

Laboratory Analysis for: ARSENIC AND URANIUM MASS

Sample Comments: SPECIAL REQUEST

Laboratory Number: P31947-19
Sampled By: SARGENT DRILLING
Location: TEST WELL
Well ID: 950

Date Collected: 07-May-2007 12:00 PM
Date Received: 14-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
ARSENIC	3.69	-	2	ug/l	200.8		05/15/07	CC
URANIUM	76.3		1	ug/l	200.8		05/15/07	CC

Note: see reverse side of report for description of acronyms and data qualifiers
For inquiries on result interpretation call: (402) 471-6435

Nebraska Health and Human Services
Regulation and Licensure - Laboratory Services
3701 South 14th Street
Lincoln, NE 68502
(402) 471-2122
(402) 471-2080 (fax)

NE3112303
BRIDGEPORT, CITY OF
WAYNE E. KAUTZ
809 Main
PO Box 280
BRIDGEPORT, NE 69336

Laboratory Report Printed on: MAY-18-07

Laboratory Analysis for: ARSENIC AND URANIUM MASS

Sample Comments: SPECIAL REQUEST

Laboratory Number: P31947-20
Sampled By: SARGENT DRILLING
Location: TEST WELL
Well ID: 950

Date Collected: 08-May-2007 12:00 PM
Date Received: 14-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
ARSENIC	3.5		2	ug/l	200.8		05/15/07	CC
URANIUM	71.1		1	ug/l	200.8		05/15/07	CC

Note: see reverse side of report for description of acronyms and data qualifiers
For inquiries on result interpretation call: (402) 471-6435

Nebraska Health and Human Services
Regulation and Licensure - Laboratory Services
3701 South 14th Street
Lincoln, NE 68502
(402) 471-2122
(402) 471-2080 (fax)

NE3112303
BRIDGEPORT, CITY OF
WAYNE E. KAUTZ
809 Main
PO Box 280
BRIDGEPORT, NE 69336

Laboratory Report Printed on: MAY-18-07

Laboratory Analysis for: ARSENIC AND URANIUM MASS

Sample Comments: SPECIAL REQUEST

Laboratory Number: P31947-21
Sampled By: SARGENT DRILLING
Location: TEST WELL
Well ID: 950

Date Collected: 08-May-2007 12:00 PM
Date Received: 14-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
ARSENIC	3.52		2	ug/l	200.8		05/15/07	CC
URANIUM	72.3		1	ug/l	200.8		05/15/07	CC

Note: see reverse side of report for description of acronyms and data qualifiers
For inquiries on result interpretation call: (402) 471-6435

Nebraska Health and Human Services
Regulation and Licensure - Laboratory Services
3701 South 14th Street
Lincoln, NE 68502
(402) 471-2122
(402) 471-2080 (fax)

NE3112303
BRIDGEPORT, CITY OF
WAYNE E. KAUTZ
809 Main
PO Box 280
BRIDGEPORT, NE 69336

Laboratory Report Printed on: MAY-18-07

Laboratory Analysis for: ARSENIC AND URANIUM MASS

Sample Comments: SPECIAL REQUEST

Laboratory Number: P31947-22
Sampled By: SARGENT DRILLING
Location: TEST WELL
Well ID: 950

Date Collected: 09-May-2007 12:00 PM
Date Received: 14-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
ARSENIC	3.46		2	ug/l	200.8		05/15/07	CC
URANIUM	72.6		1	ug/l	200.8		05/15/07	CC

Note: see reverse side of report for description of acronyms and data qualifiers
For inquiries on result interpretation call: (402) 471-6436

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Laboratory Report Printed on: MAY-18-07

Laboratory Analysis for: ARSENIC AND URANIUM MASS

Sample Comments: SPECIAL REQUEST

Laboratory Number: P31947-23
Sampled By: SARGENT DRILLING
Location: TEST WELL
Well ID: 950

Date Collected: 09-May-2007 12:00 PM
Date Received: 14-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
ARSENIC	3.83		2	ug/l	200.8		05/15/07	CC
URANIUM	77.8		1	ug/l	200.8		05/15/07	CC

Note: see reverse side of report for description of acronyms and data qualifiers
For inquiries on result interpretation call: (402) 471-6435

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Laboratory Report Printed on: MAY-18-07

Laboratory Analysis for: ARSENIC AND URANIUM MASS

Sample Comments: SPECIAL REQUEST

Laboratory Number: P31947-24
Sampled By: SARGENT DRILLING
Location: TEST WELL
Well ID: 950

Date Collected: 10-May-2007 12:00 PM
Date Received: 14-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
ARSENIC	3.53		2	ug/l	200.8		05/15/07	CC
URANIUM	74.2		1	ug/l	200.8		05/15/07	CC

Note: see reverse side of report for description of acronyms and data qualifiers
For inquiries on result interpretation call: (402) 471-6435

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Laboratory Report Printed on: MAY-18-07

Laboratory Analysis for: ARSENIC AND URANIUM MASS

Sample Comments: SPECIAL REQUEST

Laboratory Number: P31947-25
Sampled By: SARGENT DRILLING
Location: TEST WELL
Well ID: 950

Date Collected: 10-May-2007 12:00 PM
Date Received: 14-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
ARSENIC	3.42		2	ug/l	200.8		05/15/07	CC
URANIUM	75.3		1	ug/l	200.8		05/15/07	CC

Note: see reverse side of report for description of acronyms and data qualifiers
For inquiries on result interpretation call: (402) 471-6435

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Laboratory Report Printed on: MAY-21-07

Laboratory Analysis for: NITRATE
Sample Comments: SPECIAL REQUEST

Laboratory Number: P31947-12
Sampled By: SARGENT DRILLING
Location: TEST WELL
Well ID: 950

Date Collected: 07-May-2007 12:00 PM
Date Received: 14-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
Nitrate+Nitrite (As N)	3.1		.05	mg/l	353.2		05/16/07	km

Note: see reverse side of report for description of acronyms and data qualifiers
For inquiries on result interpretation call: (402) 471-6435

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Laboratory Report Printed on: MAY-21-07

Laboratory Analysis for: NITRATE
Sample Comments: SPECIAL REQUEST

Laboratory Number: P31947-13
Sampled By: SARGENT DRILLING
Location: TEST WELL
Well ID: 950

Date Collected: 08-May-2007 12:00 PM
Date Received: 14-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
Nitrate+Nitrite (As N)	2.9		.05	mg/l	353.2		05/16/07	km

Note: see reverse side of report for description of acronyms and data qualifiers
For inquiries on result interpretation call: (402) 471-6435

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Laboratory Report Printed on: MAY-21-07

Laboratory Analysis for: NITRATE

Sample Comments: SPECIAL REQUEST

Laboratory Number: P31947-14
Sampled By: SARGENT DRILLING
Location: TEST WELL
Well ID: 960

Date Collected: 08-May-2007 12:00 PM
Date Received: 14-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
Nitrate+Nitrite (As N)	2.9		.05	mg/l	353.2		05/16/07	km

Note: see reverse side of report for description of acronyms and data qualifiers
For inquiries on result interpretation call: (402) 471-6435

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Laboratory Report Printed on: MAY-21-07

Laboratory Analysis for: NITRATE
Sample Comments: SPECIAL REQUEST

Laboratory Number: P31947-15
Sampled By: SARGENT DRILLING
Location: TEST WELL
Well ID: 950

Date Collected: 09-May-2007 12:00 PM
Date Received: 14-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
Nitrate+Nitrite (As N)	2.9		.05	mg/l	353.2		05/16/07	km

Note: see reverse side of report for description of acronyms and data qualifiers
For inquiries on result interpretation call: (402) 471-6435

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Laboratory Report Printed on: MAY-21-07

Laboratory Analysis for: NITRATE
Sample Comments: SPECIAL REQUEST

Laboratory Number: P31947-16
Sampled By: SARGENT DRILLING
Location: TEST WELL
Well ID: 950

Date Collected: 09-May-2007 12:00 PM
Date Received: 14-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
Nitrate+Nitrite (As N)	3		.05	mg/l	353.2		05/16/07	km

Note: see reverse side of report for description of acronyms and data qualifiers
For inquiries on result interpretation call: (402) 471-6435

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Laboratory Analysis for: NITRATE
Sample Comments: SPECIAL REQUEST

Laboratory Number: P31947-17
Sampled By: SARGENT DRILLING
Location: TEST WELL
Well ID: 950

Date Collected: 10-May-2007 12:00 PM
Date Received: 14-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
Nitrate+Nitrite (As N)	3		.05	mg/l	353.2		05/16/07	km

Note: see reverse side of report for description of acronyms and data qualifiers
For inquiries on result interpretation call: (402) 471-6435

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Laboratory Report Printed on: MAY-21-07

Laboratory Analysis for: NITRATE

Sample Comments: SPECIAL REQUEST

Laboratory Number: P31947-18
Sampled By: SARGENT DRILLING
Location: TEST WELL
Well ID: 950

Date Collected: 10-May-2007 12:00 PM
Date Received: 14-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
Nitrate+Nitrite (As N)	3		.05	mg/l	353.2		05/16/07	km

Note: see reverse side of report for description of acronyms and data qualifiers
For inquiries on result interpretation call: (402) 471-6435

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Laboratory Report Printed on: MAY-14-07

Laboratory Analysis for: ARSENIC AND URANIUM MASS

Sample Comments: SPECIAL REQUEST

Laboratory Number: P31947-10
Sampled By: JENNIFER H
Location: OBESRVATION WELL - N. SMILOW
Well ID: 950

Date Collected: 07-May-2007 10:15 AM
Date Received: 08-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
ARSENIC	3.37	F	2	ug/l	200.8		05/09/07	CC
URANIUM	89.1	F	1	ug/l	200.8		05/09/07	CC

Note: see reverse side of report for description of acronyms and data qualifiers
For inquiries on result interpretation call: (402) 471-6436

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Laboratory Report Printed on: MAY-18-07

Laboratory Analysis for: ARSENIC AND URANIUM MASS

Sample Comments: SPECIAL REQUEST OBSERVATION WELL (B)

Laboratory Number: P31994-10
Sampled By: JENNIFER HOEVET
Location: OBSERVATION WELL-END - N. SHALLOW
Well ID: 950

Date Collected: 10-May-2007 09:55 AM
Date Received: 14-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
ARSENIC	2.78		2	ug/l	200.8		05/15/07	CC
URANIUM	81		1	ug/l	200.8		05/15/07	CC

Note: see reverse side of report for description of acronyms and data qualifiers
For inquiries on result interpretation call: (402) 471-6435

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Laboratory Report Printed on: JUN-05-07

Laboratory Analysis for: 13 PARAMETER

Sample Comments: SPECIAL REQUEST

Laboratory Number: P31947-8
Sampled By: JENNIFER HOEVET
Location: OBSERVATION WELL - N. Shallow
Well ID: 950

Date Collected: 07-May-2007 10:15 AM
Date Received: 08-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
pH	7.37			pH	150.1		05/09/07	SH
SULFATE	250		10	mg/l	EPA 375.4		06/03/07	JN
Chloride	36.4		1	mg/l	4500CL-E		05/14/07	km
IRON	1400		50	ug/l	SM3111B		05/16/07	CD
Hardness, Total	380		4	mg/l	2340C		05/09/07	SH
Solids, Total Dissolved (Tds)	930		10	mg/l	160.1		05/11/07	SH
Alkalinity, Total	380		20	mg/l	2320B		05/11/07	SH
CALCIUM	103		.15	mg/l	215.1		05/16/07	CD
SODIUM	159		10	mg/l	SM3111B		05/16/07	CD
TOTAL COLIFORM	200	>	0	cfu/10	9223B-QT		05/09/07	TW/JN
E. COLI	0		0	cfu/10	9223B-QT		05/09/07	TW/JN
Nitrate+Nitrite (As N)	1.9		.05	mg/l	353.2		05/09/07	km
Fluoride	.74		.2	mg/l	4500F-C		05/09/07	km
MANGANESE	1790	F	1	ug/l	200.8		05/09/07	CC

Note: see reverse side of report for description of acronyms and data qualifiers
For inquiries on result interpretation call: (402) 471-6436

Turbidity ?

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Laboratory Report Printed on: JUN-05-07

Laboratory Analysis for: 13 PARAMETER

Sample Comments: SPECIAL REQUEST OBSERVATION WELL (B)

Laboratory Number: P31994-9
Sampled By: JENNIFER H
Location: OBSERVATION WELL - N. SHALLOW
Well ID: 950

Date Collected: 10-May-2007 09:55 AM
Date Received: 11-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
pH	7.44			pH	150.1		05/11/07	SH
SULFATE	360		50	mg/l	EPA 375.4		06/03/07	JN
Chloride	36.3		1	mg/l	4500CL-E		05/14/07	km
IRON	181		50	ug/l	SM3111B		05/16/07	CD
Hardness, Total	370		4	mg/l	2340C		05/16/07	SH
Solids, Total Dissolved (Tds)	898		10	mg/l	160.1		05/11/07	SH
Alkalinity, Total	376		20	mg/l	2320B		05/11/07	SH
CALCIUM	95.8		.15	mg/l	215.1		05/16/07	CD
SODIUM	145		10	mg/l	SM3111B		05/16/07	CD
TOTAL COLIFORM	200	>	0	cfu/10	9223B-QT		05/12/07	JN
E. COLI	0		0	cfu/10	9223B-QT		05/12/07	JN
Nitrate+Nitrite (As N)	1.8		.05	mg/l	353.2		05/11/07	km
Fluoride	.86		.2	mg/l	4500F-C		05/17/07	km
MANGANESE	2100		1	ug/l	200.8		05/16/07	CC

Note: see reverse side of report for description of acronyms and data qualifiers
For inquiries on result interpretation call: (402) 471-6435

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Laboratory Report Printed on: MAY-15-07

Laboratory Analysis for: SPECIAL VOC 524, NON-CHLORINATED
Sample Comments: SPECIAL REQUEST

Laboratory Number: P31947-9
Sampled By: JENNIFER H
Location: OBSERVATION WELL N. Shallow
Well ID: 950

Date Collected: 07-May-2007 10:15 AM
Date Received: 08-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
Dichlorodifluoromethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
[illegible]oromethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
[illegible]l Chloride	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Bromomethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Chloroethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Trichlorofluoromethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,1-Dichloroethene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Dichlormethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Methyl-T-Butyl-Ether	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Trans-1,2-dichloroethene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,1-dichloroethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Cis-1,2-Dichloroethene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
2,2-dichloropropane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Bromochloromethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Chloroform	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,1,1-trichloroethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,1-Dichloropropene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Carbon tetrachloride	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,2-dichloroethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Benzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL

Note: see reverse side of report for description of acronyms and data qualifiers
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Laboratory Report Printed on: MAY-15-07

Laboratory Analysis for: SPECIAL VOC 524, NON-CHLORINATED
Sample Comments: SPECIAL REQUEST

Laboratory Number: P31947-9
Sampled By: JENNIFER H
Location: OBSERVATION WELL NJ, SHALLOW
Well ID: 950

Date Collected: 07-May-2007 10:15 AM
Date Received: 08-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
Trichloroethene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
...dichloropropane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
...omomethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Bromodichloromethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Cis-1,3-dichloropropene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Toluene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Trans-1,3-dichloropropene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,1,2-trichloroethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,3-Dichloropropane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Tetrachloroethene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Dibromochloromethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,2-Dibromoethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Chlorobenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,1,1,2-tetrachloroethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Ethylbenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
M,P-Xylenes	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
O-xylene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Styrene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Bromoform	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Isopropylbenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL

Note: see reverse side of report for description of acronyms and data qualifiers
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Laboratory Report Printed on: MAY-15-07

Laboratory Analysis for: SPECIAL VOC 524, NON-CHLORINATED

Sample Comments: SPECIAL REQUEST

Laboratory Number: P31947-9
Sampled By: JENNIFER H
Location: OBSERVATION WELL N. SHALLOW
Well ID: 950

Date Collected: 07-May-2007 10:15 AM
Date Received: 08-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
1,1,2,2-tetrachloroethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
3-trichloropropane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
nobenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
N-propylbenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
2-Chlorotoluene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,3,5-trimethylbenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
4-chlorotoluene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Tert-butylbenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,2,4-trimethylbenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Sec-butylbenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
P-isopropyltoluene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,3-Dichlorobenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,4-Dichlorobenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
N-butylbenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,2-Dichlorobenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,2-Dibromo-3-Chloropropane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,2,4-trichlorobenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Hexachlorobutadiene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Naphthalene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,2,3-trichlorobenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL

Note: see reverse side of report for description of acronyms and data qualifiers
For inquiries on result interpretation call: (402) 471-6435

Nebraska Health and Human Services
Regulation and Licensure - Laboratory Services
3701 South 14th Street
Lincoln, NE 68502
(402) 471-2122
(402) 471-2080 (fax)

NE3112303
~~BRIDGEPORT, CITY OF~~
WAYNE E. KAUTZ
809 Main
PO Box 280
BRIDGEPORT, NE 69336

Laboratory Report Printed on: MAY-15-07

Laboratory Analysis for: SPECIAL VOC 524, NON-CHLORINATED
Sample Comments: SPECIAL REQUEST OBSERVATION WELL (B)

Laboratory Number: P31994-11
Sampled By: JENNIFER HOEVET
Location: OBSERVATION WELL-END N. SHALLOW
Well ID: 950

Date Collected: 10-May-2007 09:55 AM
Date Received: 14-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
1,1,2,2-tetrachloroethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,2,3-trichloropropane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
n-butylbenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
N-propylbenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
2-Chlorotoluene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,3,5-trimethylbenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
4-chlorotoluene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Tert-butylbenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,2,4-trimethylbenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Sec-butylbenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
P-isopropyltoluene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,3-Dichlorobenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,4-Dichlorobenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
N-butylbenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,2-Dichlorobenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,2-Dibromo-3-Chloropropane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,2,4-trichlorobenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Hexachlorobutadiene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Naphthalene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,2,3-trichlorobenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL

Note: see reverse side of report for description of acronyms and data qualifiers
For inquiries on result interpretation call: (402) 471-6435

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Laboratory Report Printed on: MAY-15-07

Laboratory Analysis for: SPECIAL VOC 524, NON-CHLORINATED
Sample Comments: SPECIAL REQUEST OBSERVATION WELL (B)

Laboratory Number: P31994-11
Sampled By: JENNIFER HOEVET
Location: OBSERVATION WELL-END – N. SHALLOW
Well ID: 950

Date Collected: 10-May-2007 09:55 AM
Date Received: 14-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
Trichloroethene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
dichloropropane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
omomethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Bromodichloromethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Cis-1,3-dichloropropene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Toluene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Trans-1,3-dichloropropene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,1,2-trichloroethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,3-Dichloropropane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Tetrachloroethene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Dibromochloromethane	<RL		.5	ug/l	624.2	05/11/07	05/11/07	AL
1,2-Dibromoethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Chlorobenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,1,1,2-tetrachloroethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Ethylbenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
M,P-Xylenes	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
O-xylene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Styrene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Bromoform	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Isopropylbenzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL

Note: see reverse side of report for description of acronyms and data qualifiers
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Laboratory Report Printed on: MAY-15-07

Laboratory Analysis for: SPECIAL VOC 524, NON-CHLORINATED
Sample Comments: SPECIAL REQUEST OBSERVATION WELL (B)

Laboratory Number: P31994-11
Sampled By: JENNIFER HOEVET
Location: OBSERVATION WELL-END N. SHALLOW
Well ID: 950

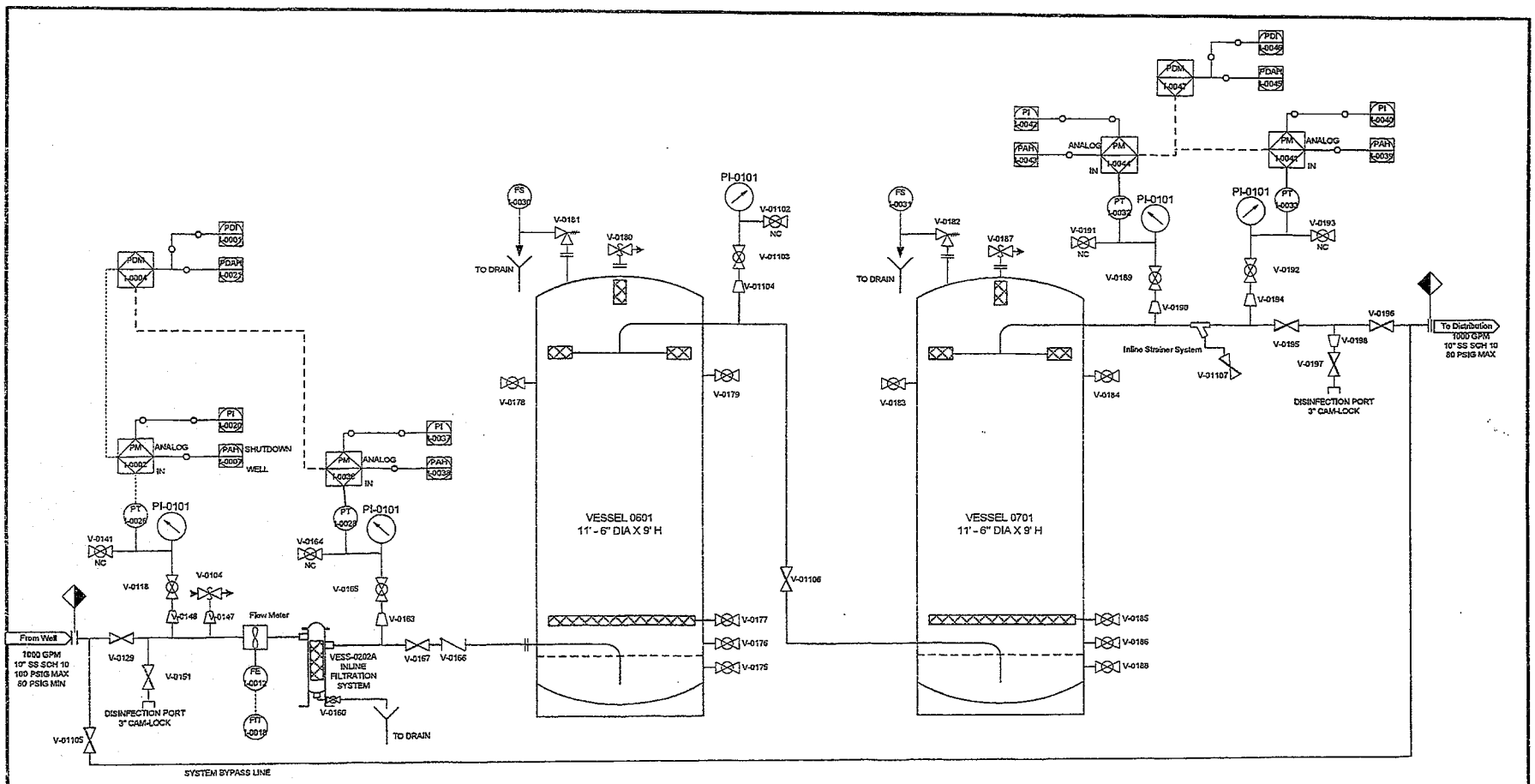
Date Collected: 10-May-2007 09:55 AM
Date Received: 14-May-2007

Parameters	Test Results	Qual	Report Level	Units	Method	Prep Date	Analysis Date	Analyst
Dichlorodifluoromethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Bromomethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Vinyl Chloride	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Bromomethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Chloroethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Trichlorofluoromethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,1-Dichloroethene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Dichlormethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Methyl-T-Butyl-Ether	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Trans-1,2-dichloroethene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,1-dichloroethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Cis-1,2-Dichloroethene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
2,2-dichloropropane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Bromochloromethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Chloroform	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,1,1-trichloroethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,1-Dichloropropene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Carbon tetrachloride	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
1,2-dichloroethane	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL
Benzene	<RL		.5	ug/l	524.2	05/11/07	05/11/07	AL

Note: see reverse side of report for description of acronyms and data qualifiers
For inquiries on result interpretation call: (402) 471-6436

Appendix G

Treatment Proposals



NOT FOR BID
NOT FOR CONSTRUCTION

NOTES:
1. TUBING TO BE ½" PP
2. ROUTE ALL SAMPLE LINES TO COMMON SAMPLE SINK
3. MOUNT PRESSURE GAUGES IN A ROW WITH UNISTRUT
4. INLET FLOWS AND PRESSURE LISTED ARE TO BE SUPLIED BY CUSTOMER

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NO.	REVISIONS	BY	CHK'D	APP'D	DATE

CUSTOMER: BRIDGEPORT, NE
FOR INFORMATION ONLY

TITLE: WRT URANIUM REMOVAL
1000 GPM SYSTEM

DWN: JDT DATE: 06/20/07

12-P&ID-01

REV. 0

July 5th, 2007

Mr. Rod Kirkland
Olsson & Assoc.
Lincoln, NE
Tel: 402-458-5667

Subject: Bridgeport, NE – Budget Proposal for Uranium Removal

Rod,

We appreciate the opportunity to provide you with this budget proposal for WRT's Uranium Removal System.

WRT designs, builds and maintains this proprietary, patent pending system to reduce uranium levels to less than 30 µg/L.

RMD, a related company, provides all operation and disposal services.

WRT's Uranium Removal System is designed to be added to any new or existing potable water system. Water passes through treatment columns where uranium is removed. After the media is loaded with uranium, it is removed from the circuit by WRT, who is responsible for the complete process including the safe, long term disposal of the media.

Advantages of the WRT Uranium Removal System include:

- Nothing is added to the water. No chemicals are added in the treatment process, and nothing is imparted into the water during the treatment process.
- No liquid waste stream is generated by this process.
- Proper disposal of material by RMD.
- Minimal Maintenance and Operation required, only routine sampling and monitoring. No handling of radioactive materials, media or chemicals by Utility personnel.
- Uranium Removal Media is NSF, Standard 61 certified for use in drinking water applications.
- Guaranteed process, payment only upon performance.

July 5th, 2007

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Advantages of the WRT Uranium Removal System include:

- Nothing is added to the water. No chemicals are added in the treatment process, and nothing is imparted into the water during the treatment process.
- No liquid waste stream is generated by this process.
- Proper disposal of material by RMD.
- Minimal Maintenance and Operation required, only routine sampling and monitoring. No handling of radioactive materials, media or chemicals by Utility personnel.
- Uranium Removal Media is NSF, Standard 61 certified for use in drinking water applications.
- Guaranteed process, payment only upon performance.

This preliminary proposal is based upon WRT/RMD providing a complete WRT Uranium Removal System under a long term contract, including equipment, media, exchange of media when required and proper handling and disposal of used media. The equipment is comprised of two vessels which contain the treatment media, in addition to connection piping, valves, controls and instrumentation. This equipment is provided to the treatment site by WRT and remains the property and liability of WRT. WRT delivers and RMD installs media as required directly into the treatment vessels at the well site. RMD removes used media directly out of the treatment vessels, into a service vehicle at the well site. All handling of media is done by RMD. Analytical fees for laboratory analysis of samples taken for operational purposes are paid by WRT. Used media will be disposed of in an approved facility.

In summary, WRT/RMD will provide the following:

- Design and provide WRT Uranium treatment system at one treatment site.
- Supervise installation of system.
- Provide Operator training and Operation and Maintenance Manuals.
- Maintain system during period of contract.
- Handling of all media.
- Installation and replacement of media.
- Transport and disposal of media.
- Operating analytical fees (analysis of samples required by WRT for operational monitoring).
- Meeting the current MCL for Uranium or such lower level as may be mutually agreed.

The Utility will provide the following:

- Provide water at current water quality and specified pressure.
- Site for treatment system.
- Building to house system.
- Installation of system.
- Site access for media loading and unloading.
- All permitting and approvals.
- Maintain site, excluding WRT treatment system.
- Provide utilities to operate system.
- Property taxes, use fees.
- Sign confidentiality agreement.
- Sampling as required by the Utility, government officials or WRT.
- Compliance analytical fees (analysis of samples required for regulatory compliance).
- Daily monitoring.

WRT Proposed Terms of Contract

- Term of contract is 20 years.
- Cost will be a price per year, based on agreed minimum usage amount.
- Additional usage will be billed on a cost/1,000 gallons treated basis.
- Price will be adjusted annually, based upon the Consumer Price Index (CPI).

Based on the preliminary water quality information you provided, we have prepared a *budget* estimate for the treatment of uranium to meet the 30 µg/L standard, subject to completion of the pilot study at your facility to verify our anticipated test results. Upon completion of the Z-92™ field pilot study, a firm proposal will be provided.

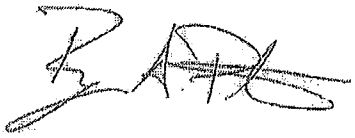
Provided below is preliminary budgetary pricing, based on the following design criteria:

Bridgeport, NE	
Hydraulic capacity of treatment point	2,000 GPM
Annual water production at this site (base gallons)	215,000,000 gallons
Uranium level in the water to be treated	80 µg/L
Number of sites/treatment locations in this proposal	1 site
Required Uranium level of treated water	<30 µg/L
Budget Cost	
Budget cost for treated water including process equipment, operating media, exchange and proper disposal of media as detailed herein. *	$1,185,000.00 equipment cost, plus $543,950.00 per year for base gallons, plus $2.53/1,000 for additional gallons treated

* This proposal is based upon today's costs, and is valid for a period of 120 days unless stainless steel prices go up drastically, which would cause WRT to revise this pricing. This price permits an annual usage of 215,000,000 gallons at this treatment site. This price is based upon the water quality information provided, and is subject to verification which may include a field pilot study. Equipment delivery is approximately 16-20 weeks after receipt of signed contract and approved drawings. The Utility will be required to provide a site and housing for the equipment as required for weather and security protection, installation, electrical service and power, connection piping into and out of the system, and any site engineering, bonding and permitting. Note that taxes are not included.

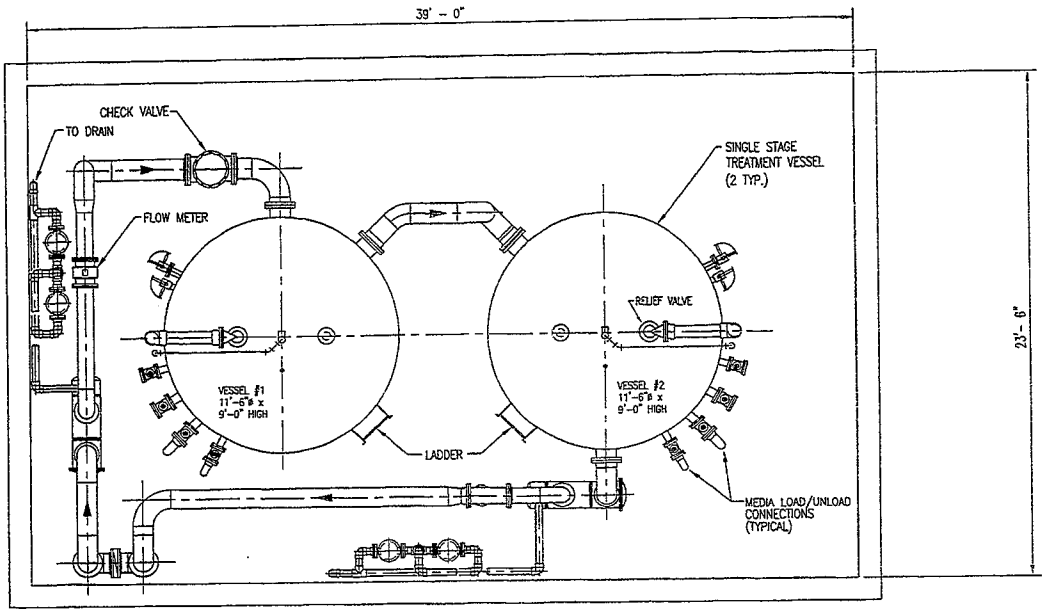
As discussed previously, this is only a budget proposal, shortly after the completion of the WRT Z-92™ pilot study a complete report and firm priced proposal will be provided. Thank you for your interest in our company and we look forward to the opportunity to work with you on this project. Please feel free to contact me with any questions or comments.

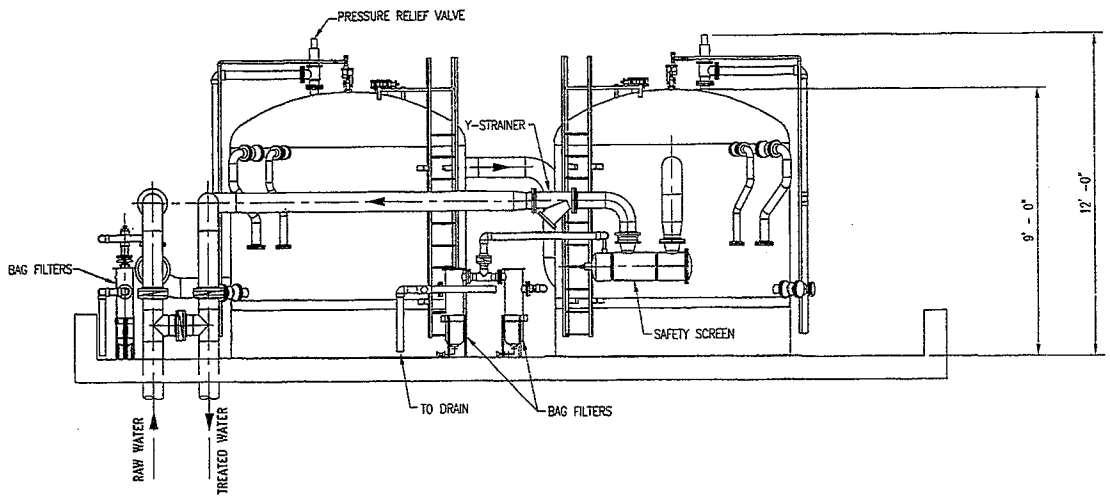
Best Regards,



Ryan A. Peterson

Central Region Sales Manager
Water Remediation Technology, LLC





NOTES:

- DIMENSIONS AND PIPING ORIENTATIONS ARE APPROXIMATE
- WRT WILL ACCOMMODATE OTHER LAYOUTS AS REQUIRED
- SYSTEM CAN INCLUDE PUMP CONTROL VALVE, BOOSTER PUMP, ETC.
- BAG FILTER DRAIN CAN BE DISCHARGED OR RE-PUMPED
- 13-15 PSI SYSTEM PRESSURE DROP
- WRT PROVIDES VESSEL, Z-92™ MEDIA, INSTRUMENTS, VALVES, & EQUIPMENT
- CUSTOMER PROVIDES LOCAL ENGINEERING, INSTALLS SYSTEM, AND COMPLETES AND PROVIDES PIPING

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WATER REMEDIATION TECHNOLOGY
WHEAT RIDGE, COLORADO

Z-92™ URANIUM REMOVAL SYSTEM
DUAL TANK SYSTEM, 1000 GPM

BRIDGEPORT, NE

FILE NAME: 0088 DUAL TANK LAYOUT | VERSION DATE: 3/6/07